IsoLoop™ 10-30 HF Antenna
LC-2 Loop Controller

Operating Manual

Advanced Electronic Applications, Inc.

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1. HELPFUL HINTS

The following was sent in by John Pollock, KA7MCX, regarding some of his experiences with the IsoLoop 14-30 antenna. You may want to read this section now, as it might provide you with some insight as you set up and operate the antenna for the first time. We also recommend re-reading this section after you complete the installation and have operated the IsoLoop a few times, as some of the terms and ideas used will be more familiar at that time.

Why was I one of the first to buy the original IsoLoop? Many times the first few days thereafter I seriously pondered that question. The durn thing wasn't working, the instructions were less than clear, and I was hearing lots of "told you so's" from friends. I was on the verge of returning my IsoLoop for something more conventional, but decided instead to call the folks at AEA who had had the gall to put this weird product on the market.

A phone call to AEA's Customer Service made a big difference. From then on, the more I used my 'Loop, the better it seemed to play. Some of the mistakes I had been making were due to my inability to understand the instructions, others were due to plain old operator incompetence. All were, in retrospect, dumb! But as most of them could still apply to the new (and greatly improved) 10-30 IsoLoop, I'll list a few hard learned experiences that just may help someone else.

Coax. After I assembled my original 'Loop, I climbed to the roof and connected it to an unused piece of RG-8. Results were disappointing; finally bought some new, lighter coax and things suddenly got much better. Heavy coax does not appear to be essential and fresh coax is well worth the small investment.

Tuners. I first used my 'Loop with a Kenwood TS-440S. As this rig has the optional internal automatic tuner, it was in this position when I connected the coax. Not knowing whether to fist tune the 'Loop or the 440, I tried both methods — with horrible results. After one of the phone calls, I set the AT-TUNE switch to OFF, and the difference was dramatic! And it certainly made things more simple when I later used the 'Loop with a TS-680S – meant I didn't have the cost and bother of an external tuner.

Frequency Modulation. I have a few of the ten meter repeaters programmed into memory channels, as it can be interesting to hear FM signals from the other side of the country, or even across the Pacific. The first time I tried to use the 'Loop on the of these, it wouldn't tune – until I switched the mode from FM to USB. Once tuned, I switched back to FM and worked repeaters on several frequencies. Moral: tune in SSB, CW or AM modes, not FM. **[White noise will not "peak" in FM mode!]**

QSO's. It seemed natural to tune across the bands until I heard an interesting QSO in progress, then to tune the 'Loop on the received signal(s). I soon learned that this was a tough way to do it because

SSB signals cause the "S" meter to bounce so much that it is almost impossible to identify the "hot spot" while tuning across it. Much better to find a nearby frequency and tune on the "white noise"; even better to find an RTTY signal or a heterodyne where the "S" meter will have little or no fluctuations. **[Also, turn the AGC switch to "FAST" position to you can see the fast peak on the "S" meter while tuning.]**

Audio. The IsoLoop is something the engineers call a "high Q" design. I now understand that means it is very efficient, but only within a very narrow frequency range. The motor driven capacitor lets you move that one spot over several bands; learning to find that "hot spot" quickly is the key to really enjoying a 'Loop. My technique when changing bands is to first turn up the transceiver's audio much higher than normal, then run the motor switch at full speed in one direction. The higher the gain, the easier it is to hear that very quick burst of noise the first time the 'Loop tunes through it. Then change to the slowest speed and run the motor in the opposite direction, while carefully watching the "S" meter. Now turn the gain down to a comfortable level. Tweak the motor a click or two at the slowest speed as you tune up or down a band. It should not be necessary to adjust the audio level if you pay attention to that "S" meter.

Direction. Soon after learning how to use it, I used the 'Loop in the CQWW; I wondered if it might be possible to work DXCC during the contest weekend. (Turned out it was – 116 countries in less than 24 hours operating time!) Each time I changed bands, I would carefully note which direction the motor switch was working as I would "hunt & pounce" up a given band. When I later returned to the previous band, I would tweak the switch the same direction as I tuned up that band. Sometimes it would work, sometimes it wouldn't. Finally figured out that each time that giant capacitor inside the 'Loop makes one complete revolution, it tunes through any given frequency twice; once in each direction.
[This is important to understand. If you hold down one direction button on the LC-2, the IsoLoop's tuned or resonant frequency will go up to the end of the range and then back down, or vice versa. It will not go up to 30 MHz and then start over again at 10 MHz.]
I soon learned to listed carefully the first time I moved the VFO after tuning the 'Loop – to nudge the motor just a bit in each direction until I was sure "which way was up".

Bandwidth. During that contest, I learned that on ten meters I could often move as much as forty to fifty kHz before retuning the IsoLoop. When ten **[the 10 meter band; 28 to 29.7 MHz]** shut for the night and I moved to twenty **[the 20 meter band; 14.0 to 14.35 MHz]**, I was not doing as well. Eventually I figured out that the lower the frequency, the narrower the "hot spot" and the more frequently it was necessary to retune. I now tend to tune every 30-40 kHz on ten meters but every 10 kHz when on twenty meters. I also discovered the fun to be had on the twelve and seventeen meter bands – I tune the 'Loop near the center of either the CW or SSB portion, and seldom find it necessary to retune as I listen across these narrow bands. And

the 'Loop compares favorably with many of the stations on these bands, not nearly so many giant monobanders and legal limit amps to compete against.

Mobile. My primary objective when purchasing the IsoLoop was to have convenient low band capabilities on my TS-680S when the six meter band went dead while I was miles from nowhere during some VHF contest. I had in mind some quick and simple mounting system that would not get in the way of my VHF/UHF beams. Discovered that a small roof tripod could be easily snapped on and off my vehicle's luggage rack, and that the 'Loop seemed to work well with only a five-foot mast. I finished a few test QSO's from my driveway, and the tripod looked solid, so I left it in place while taking the YL on a grocery run. Six bags later, I had worked three continents from the parking lot, and it would be nearly three months before I removed the tripod! I ran a few A/B comparisons with my previous set of mobile whips; soon I learned that the IsoLoop was hearing and being heard much better. Horizontal polarization may have had something to do with that, but the difference was dramatic while driving among the city's skyscrapers. A "freeway flutter" essentially disappeared, perhaps due to less flexible antenna configuration. Hint: That less-than-flexible configuration can be unforgiving on tree-lined side streets and country lanes. Drive verrrrrry(!) slowly under such circumstances.

Listening. Because it is omni-directional (when in a horizontal configuration) the IsoLoop can be a superb listening antenna, on the Short Wave bands as well as amateur bands. But tuning quickly across several bands requires patience and skill. I sometimes use a random wire with an A/B switch to "check the band" or to look for interesting signals between the bands. As soon as I find action on an interesting band, I switch to the 'Loop and tune for maximum signal strength. I've also learned that my six-meter antenna can sometimes work for spotting, finding interesting signals to work with the IsoLoop.

If you have hints or suggestions about the IsoLoop (or any of our products) that may help others enjoy it more, please write to us! In the case of the IsoLoop, there are so many different configurations and ways it can be used, we can't possibly try them all here. So, let us know what you're doing with *your* 'Loop!

2. FEATURES

The IsoLoop is a tuned loop antenna and consists of a band of aluminum (acting as a radiating inductor) with a stepping-motor-driven tuning capacitor mounted in series with the band. The LC combination is made to resonate at the chosen operating frequency. The loop has very high Q and the bandwidth is quite narrow, resulting in attenuation of any harmonics from the user's transmitter, or strong local signals from any adjacent transmitter.

Tuning is accomplished by controlling the stepping motor from a small remote control box called the LC-2 Loop Controller. It allows forward/reverse direction and speed control of the motor. An audio level indicator consisting of an array of 4 LEDs coupled with a sensitivity control pot allows easy visual tuning of the loop at resonance. A frequency indicator helps speed tuning by showing the current resonant frequency

The IsoLoop is small in size, and is excellent in limited-space applications such as apartments or attics. It may be easily carried to remote locations.

Figure 1 shows that the IsoLoop may be mounted in either the horizontal (1b and c) or vertical (1a) plane. Vertical mounting allows the antenna pattern to be rotated with a rotator to "null" interfering signals. When mounted in the horizontal plane, the pattern is omni-directional. Ground radials are not necessary and the impedance is approximately 50 ohms when tuned to a chosen frequency — an additional antenna tuner is not necessary.

The IsoLoop design results in the loop antenna being *isolated* or decoupled from the feedline so the feedline does not become part of the radiating structure and distort the pattern. (This is the source of the "IsoLoop" name.) Another benefit is that the operator does not have RF in his operating environment — his (and the neighbor's) equipment is less likely to be interfered with.

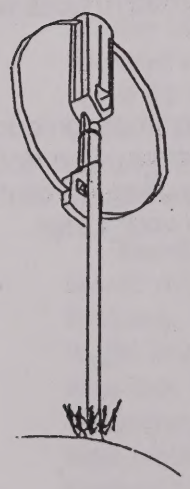


Fig. 1a

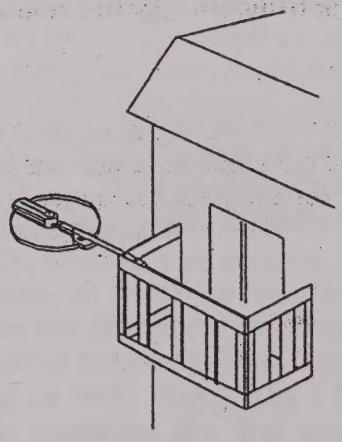


Fig. 1b

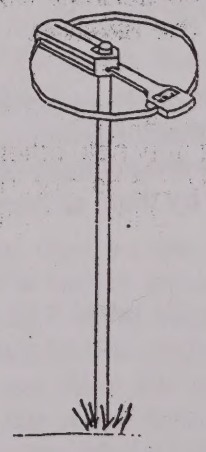


Fig. 1c

3. THEORY OF OPERATION

The IsoLoop antenna consists of a radiating LC series combination and resonates at the chosen operating frequency. It is inductively coupled to a shielded primary loop which is driven by the feedline from the radio. The main loop has very high Q and the bandwidth is quite narrow — approximately 10-100 kHz depending on the operating frequency.

The IsoLoop is an antenna where bandwidth has been traded off for efficiency, and as such, the gain of the antenna is comparable to that of a dipole. It works much better than a dipole at heights lower than a half-wave, and works much better indoors. It does not have quite the gain of a dipole in free-space, but most of us are not able to mount a dipole high enough to achieve free-space performance.

4. SPECIFICATIONS

Frequency Coverage	10 to 30 MHz
Nominal Impedance (tuned)	50 ohms
Power Rating	150 watts
VSWR	Less than 1.4:1 (no nearby objects)
Temperature Range	0 to 150° Fahrenheit operating
	-50 to 150° Fahrenheit storage
Dimensions	35" round, 38.8" housing
Max. Mast Outside Diameter	2"
Shipping Weight	25 pounds
Coax Connector	UHF (SO-239)
Gain	Approximately that of a dipole

5. UNPACKING INSTRUCTIONS

CAUTION: the aluminum band has been slightly compressed to fit snugly in the shipping carton. Carefully and slowly pull the assembly from the carton, keeping it at arm's length in the event it may try to spring back into its original shape. Remove all packing tape, then gently bend the band to a circular shape, if necessary (*note that the antenna's performance will not be significantly affected if the loop is out of round*). Be sure to keep the box and all packing materials.

Remove the packing tape from the control cable, then temporarily route the loose end to a location within a few feet of a 110 VAC electrical outlet.

Remove the LC-2 controller from its box.

Remove the AC-1 power transformer from its carton. insert the end of the power cable into the outlet on the rear of the LC-2 marked "12 VDC". Then plug the AC-1 transformer into the AC outlet.

Turn the right hand circular switch on the front of the LC-1. You will feel a click as the power is switched on and you will also notice one or more LEDs will light.

Press one of the arrow keys. You should hear the motor turning inside your IsoLoop. Press the other arrow key to be sure the motor is turning in both directions.

Check the packing list on page 14 to verify that all additional parts are present; your IsoLoop is now ready for mounting.

6. MOUNTING THE ISOLOOP

Give careful consideration to the location you select for mounting your IsoLoop. The sketches on page 2 show some of the more conventional mounting arrangements, but use your imagination and ingenuity to determine one that will be best for your particular installation. You may wish to make a temporary installation initially in a location that is conveniently accessible, until you have had a chance to test its operation an the air. A step ladder or stool may be used as a temporary support.

As with most other antennas, mounting your IsoLoop may require you to make some choices relative to strength, safety, aesthetics, cost, etc.; here are some suggestions:

Mount your IsoLoop as high above the ground, your roof, other structures, etc. as is practical. Your IsoLoop will perform quite efficiently on a ten or fifteen foot mast, but additional height will usually improve performance.

Be sure the mast is secure. If it is more than twenty feet high, you may wish to consider guying it, depending on the highest wind speeds that may occur at your location. Think for a moment about where the IsoLoop could end up if the mast were to collapse under a "worst case" situation; could it damage a window? a skylight? an awning? Could it fall across power lines? telephone lines? cable TV lines? Keep your coax cable runs as short as practical. This may mean mounting your IsoLoop on that portion of your roof directly above your transceiver even if the other end of the roof is more accessible. Mount your IsoLoop as far as possible from other antennas, towers, masts, guy wires, utility lines, etc. When practical, mount it away from other non-conductive objects such as chimneys, trees, signs, flagpoles, etc.; these can attenuate signals on certain frequencies, particularly when they are wet or covered with ice or snow.

Take a moment to think about the visual impact of your IsoLoop on your neighbors' views. Even though the IsoLoop is one of the most aesthetically attractive antennas around, your non-ham neighbors may not see it that way. Will the rising or setting sun reflect from the loop directly into their picture windows? Will moving it a bit in one direction or another make it less visible? It might be worth a short visit to your neighbor(s) prior to mounting your IsoLoop; take along a magazine or catalog showing some massive beams, explain how you were thinking of them when you chose to put up this small, attractive antenna instead.

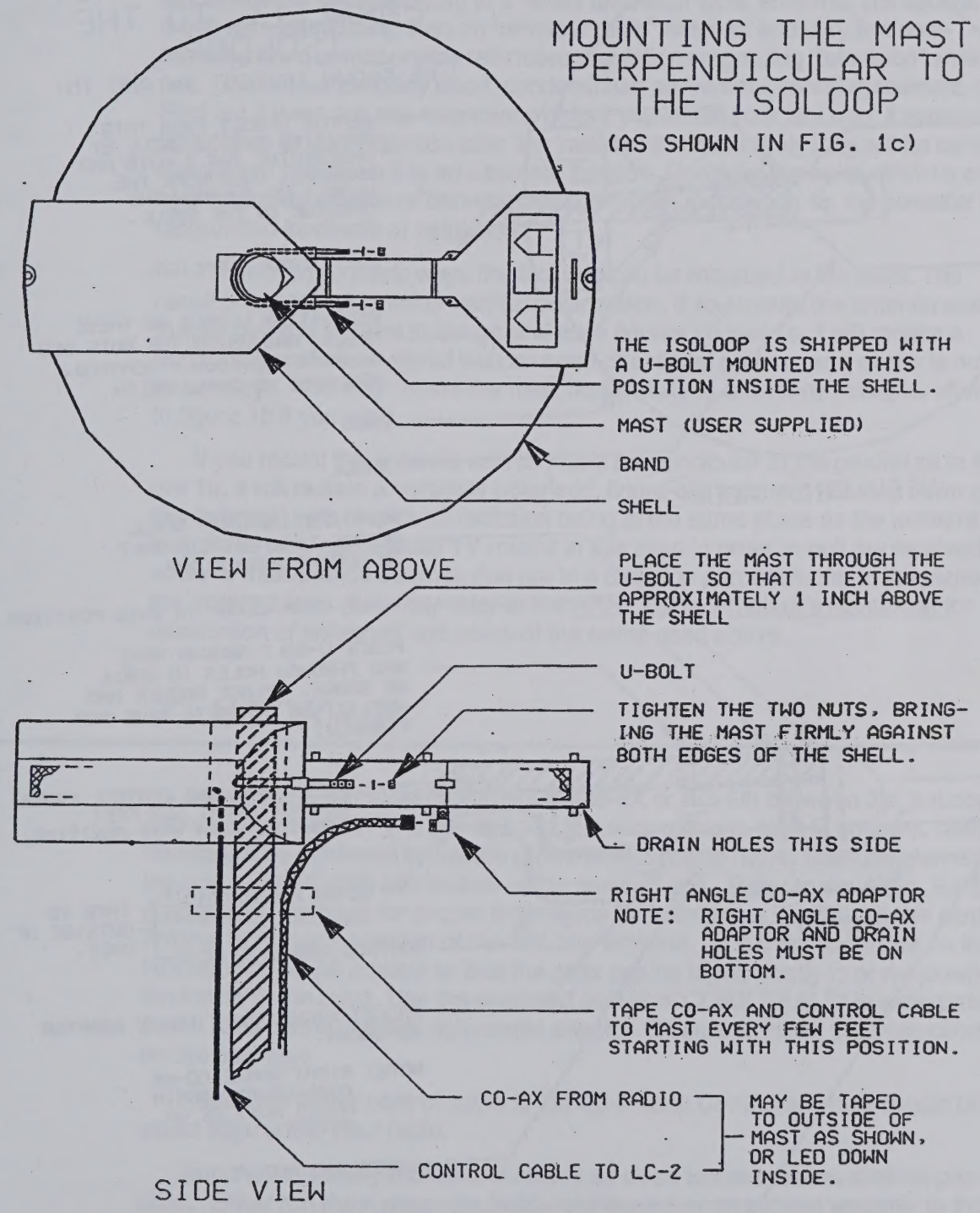

MOUNTING THE MAST PERPENDICULAR TO THE ISOLOOP
(AS SHOWN IN FIG. 1c)
THE ISOLOOP IS SHIPPED WITH A U-BOLT MOUNTED IN THIS POSITION INSIDE THE SHELL.
MAST (USER SUPPLIED)
BAND
SHELL
VIEW FROM ABOVE
PLACE THE MAST THROUGH THE U-BOLT SO THAT IT EXTENDS APPROXIMATELY 1 INCH ABOVE THE SHELL
U-BOLT
TIGHTEN THE TWO NUTS, BRINGING THE MAST FIRMLY AGAINST BOTH EDGES OF THE SHELL.
DRAIN HOLES THIS SIDE
RIGHT ANGLE CO-AX ADAPTOR
NOTE: RIGHT ANGLE CO-AX ADAPTOR AND DRAIN HOLES MUST BE ON BOTTOM.
TAPE CO-AX AND CONTROL CABLE TO MAST EVERY FEW FEET STARTING WITH THIS POSITION.
CO-AX FROM RADIO
CONTROL CABLE TO LC-2
MAY BE TAPED TO OUTSIDE OF MAST AS SHOWN, OR LED DOWN INSIDE.
SIDE VIEW
NOTE: SUPPLIED WORM CLAMP IS NOT USED FOR THIS CONFIGURATION

Fig. 2

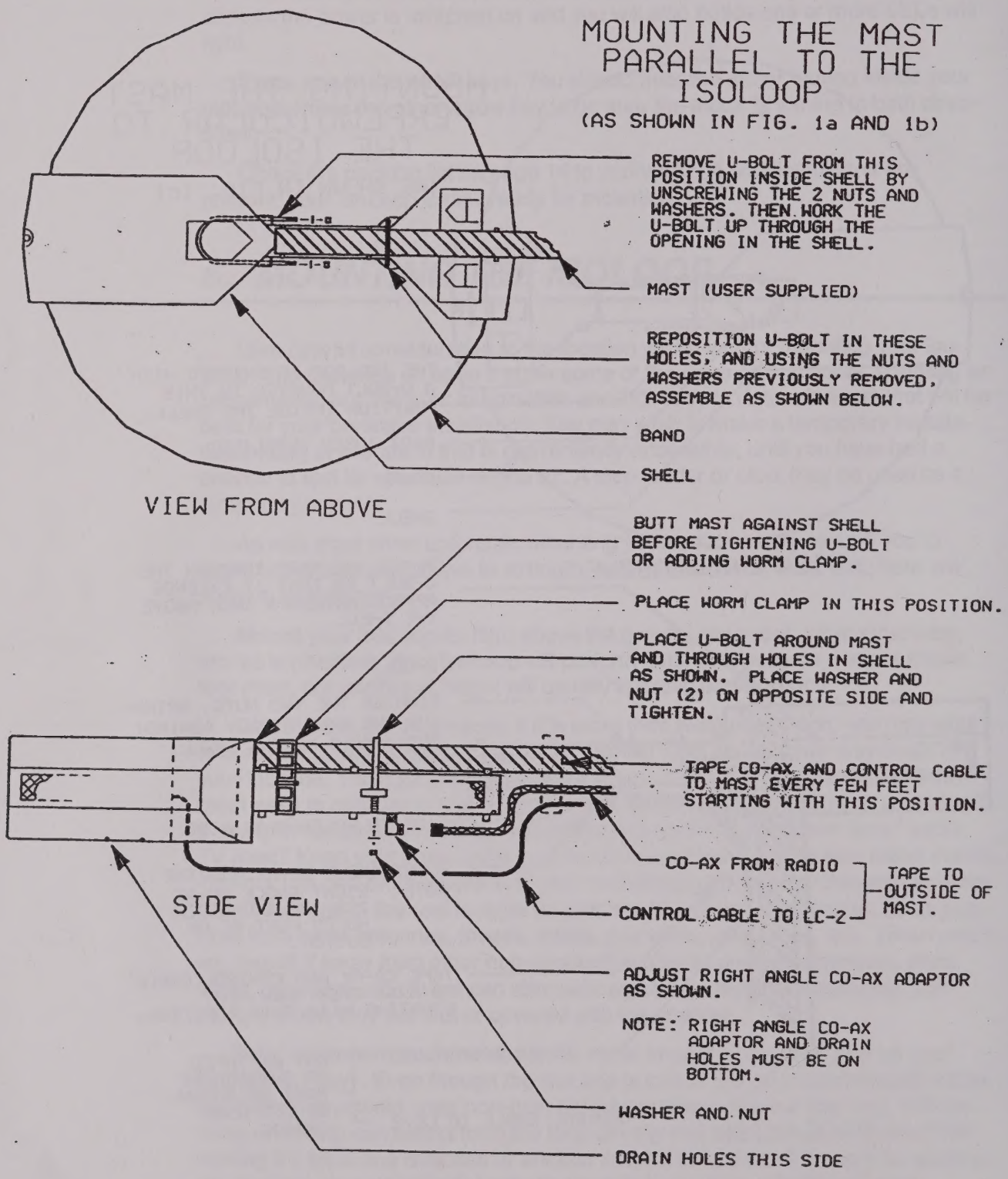

MOUNTING THE MAST PARALLEL TO THE ISOLOOP
(AS SHOWN IN FIG. 1a AND 1b)
REMOVE U-BOLT FROM THIS POSITION INSIDE SHELL BY UNSCREWING THE 2 NUTS AND WASHERS. THEN WORK THE U-BOLT UP THROUGH THE OPENING IN THE SHELL.
MAST (USER SUPPLIED)
REPOSITION U-BOLT IN THESE HOLES, AND USING THE NUTS AND WASHERS PREVIOUSLY REMOVED, ASSEMBLE AS SHOWN BELOW.
BAND
SHELL
VIEW FROM ABOVE
BUTT MAST AGAINST SHELL BEFORE TIGHTENING U-BOLT OR ADDING WORM CLAMP.
PLACE WORM CLAMP IN THIS POSITION.
PLACE U-BOLT AROUND MAST AND THROUGH HOLES IN SHELL AS SHOWN. PLACE WASHER AND NUT (2) ON OPPOSITE SIDE AND TIGHTEN.
TAPE CO-AX AND CONTROL CABLE TO MAST EVERY FEW FEET STARTING WITH THIS POSITION.
CO-AX FROM RADIO
CONTROL CABLE TO LC-2
TAPE TO OUTSIDE OF MAST.
SIDE VIEW
ADJUST RIGHT ANGLE CO-AX ADAPTOR AS SHOWN.
NOTE: RIGHT ANGLE CO-AX ADAPTOR AND DRAIN HOLES MUST BE ON BOTTOM.
WASHER AND NUT
DRAIN HOLES THIS SIDE

Fig. 3

Call your local building department to be certain you will not be violating any ordinances, and that you will not require any building permits. You might wish to ask about any rules applying to a "small television-type" antenna; this sounds much less intimidating than an "amateur radio" antenna and very few communities have unreasonably restrictive regulations regarding "television" antennas. Check your property deed, condominium agreement, rental agreement, etc. Find out if there are any restrictions before you install your IsoLoop; if someone calls these to your attention after it is installed it is quite likely they will be carefully watching if you move it to an alternate location. Consider the trade-offs of a concealed (inside an attic or beneath a balcony roof) installation vs. the potential for disgruntled landlords or neighbors.

There are two basic ways the IsoLoop can be mounted to the mast. The result is either horizontal or vertical polarization. If you mount the antenna such that its plane is parallel to the ground as in figures 1b and 1c, it will radiate a horizontally polarized signal with an omni-directional pattern, and a rotor is not necessary. You may mount the mast horizontally to a balcony railing as shown in figure 1b if you wish.

If you mount the antenna with its plane perpendicular to the ground as in figure 1a, it will radiate a vertically polarized, figure-eight pattern (looking down on the antenna) with maximum radiation being in the same plane as the antenna loop. You may use a small TV rotator in this case in order to null out received noise or interference sources that are in a direction perpendicular to the plane of the antenna loop. You may refer to the ARRL Radio Amateur's Handbook for description of antennas and some of the terms used above.

7. HOOK-UP

Install 50 ohm coaxial cable (RG-8, RG-8X or RG-58) between the IsoLoop and your transceiver. (As the IsoLoop is a very efficient, high Q antenna, best results will be achieved by installing new coaxial cable rather than using an existing one.) Use PL-259 connectors at the IsoLoop end. Refer to the ARRL Radio Amateur's Handbook for proper techniques for installing a PL-259, as this step is **critical** to proper operation of the IsoLoop antenna. The coax connector on the IsoLoop should be rotated so that the coax can be taped neatly to or run down the inside of the mast. Use the enclosed packet of COAX SEAL™ to waterproof the PL-259 connector and right-angle adaptor. Be sure to follow the instructions on the package.

Attach the motor control cable to the LC-2 Loop Controller which should be located adjacent to your radio.

Run the RF (coax) and control cables as close to the antenna shell as possible. Either run them down the inside of the mast or tape them securely to the mast every few feet. If 50' of control cable is not long enough, you may purchase a 50' extension either from us or from your favorite authorized dealer. Call (206) 774-1722 if you wish to order direct.

CAUTION — CAUTION — CAUTION

Because of the doughnut shaped pattern of the IsoLoop, there is a minimum field point in the center of the loop where the mast is mounted. It is VERY IMPORTANT that you follow the above directions as to the "dress" of the two cables. If they are allowed to simply "hang" vertically from the ends of the loop, they will pick up significant energy on the outside of the cable and distort the pattern and carry RF into your radio operating environment. For best results, the cables need to be kept as close as possible to the body of the antenna and mast, otherwise, your VSWR may be higher than it should.

The LC-2 controller has a signal strength indicator in the form of four LEDs on the front panel. This feature can help make tuning the antenna much easier by helping you determine when signal strength is maximum. To use this feature, you will need to run an audio signal to the LC-2 as follows: Hook up the supplied audio cable from your receiver's EXTERNAL SPEAKER output to either of the AUDIO jacks on the LC-2. Wire a 2-conductor cable to a monitor speaker using the 2-conductor jack included in the hardware package. Connect this cable to the other AUDIO jack on the LC-2. See figure 4.

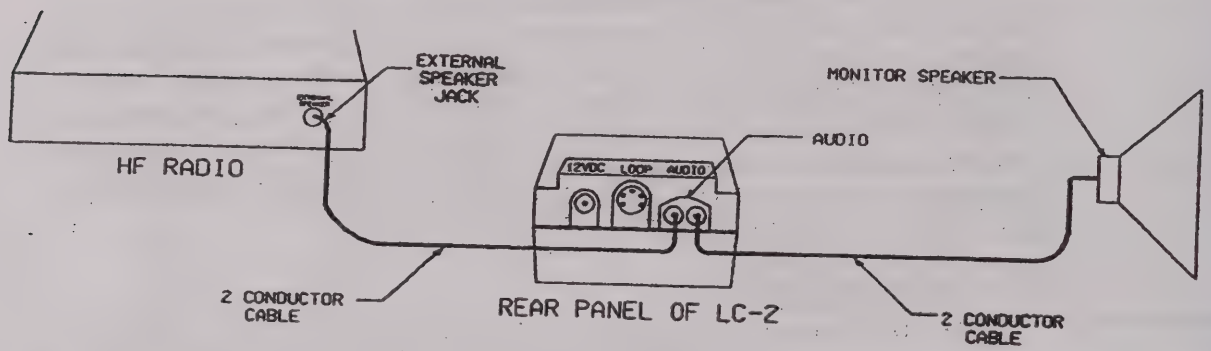


Fig. 4

8. FOR YOUR HEALTH AND SAFETY

Presently, there is not significant data on the hazards of long-term exposure to signals transmitted in the 10 to 30 MHz range. Some scientists do have concern and are studying the problem. It is always good practice to place any transmitting antenna as far away from humans as practical — you should try to maintain at least a 10 foot spacing.

CAUTION — CAUTION — CAUTION

Locate the IsoLoop so that NOTHING, especially living beings can come in physical contact with it under any transmit conditions. RF arcing and burns may result if the antenna is touched when transmitting, particularly at high power conditions.

The IsoLoop is a very high-Q device and as a result the RF circulating currents and the RF voltages may be quite high. DO NOT TOUCH THE ANTENNA WHILE TRANSMITTING ! ! !

9. LC-2 CALIBRATION

The LC-2's frequency indicator must be calibrated initially for proper operation. Perform the following procedure.

1. Tune your receiver to the 21 MHz band. Be sure that the LC-2 sensitivity control (SENS) is **not** fully to the right (counter-clockwise). A switch detent at full right (CCW rotation) disconnects one of the antenna stepper motor windings and prevents rotation of the motor. If the controller is not illuminated, move the speed (SPEED) control to the left (clockwise) to activate the power switch.
2. Tune the antenna using the LC-2 controller for maximum receiver noise (or signal) output. Now set the sensitivity control full right (CCW) until the switch clicks to the OFF position. Operate the LC-2 direction control(s) until the dial indicates 21.
3. Operate the sensitivity control to the left (CW) until the switch clicks on.
4. Tune your receiver to either the 28 MHz or 14 MHz band. Tune the antenna with the LC-2 for maximum noise or signal, ignoring the frequency wheel indication. If, once tuned, the dial indication is correct for the band (or very close to it), the calibration is complete.

   If the dial is showing the wrong band, again move the sensitivity switch to the right until the switch clicks. Operate the LC-2 directional control that moves the frequency wheel initially away from the 21 MHz band until the frequency you have chosen again appears in the window. The frequency indication will have to continue past the end of the antenna frequency range (either 10 MHz or 30 MHz) and back to your chosen band. You may pass 21 MHz. Now operate the sensitivity switch to the left (clockwise). The calibration is complete.

10. OPERATION

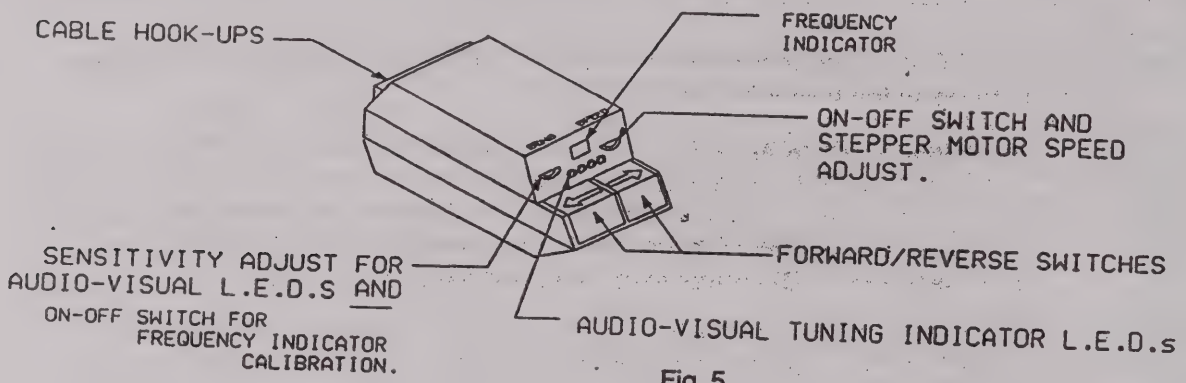


Fig. 5

DO NOT USE AN ANTENNA TUNER WITH THE ISOLOOP. ALSO, IF YOUR TRANSCEIVER HAS A BUILT IN OR AUTOMATIC TUNER, TURN THAT FUNCTION OFF BEFORE USING THE ISOLOOP.

Turn your transceiver on and tune the receiver to a frequency in the 10 to 30 MHz range.

Turn the SPEED control of the LC-2 to the inside (see Figure 5). As the switch clicks, the pilot light should flash. Just beyond the switch click is the high speed position. Further rotation to the left or inside will decrease the speed of the stepper motor. The relative speed of the stepper motor is indicated by the rate at which the pilot light flashes.

There are basically two ways to tune your IsoLoop antenna: By maximum signal on receive (as indicated by noise level from your receiver's speaker or by the number of LEDs lit on the LC-2) and by minimum SWR on transmit (as indicated by either lowest SWR or highest forward power). Depending on your transceiver, one of these methods may be more effective than the other; it is likely, however, that you will use the received signal to rough tune and the SWR to fine tune.

Start with the SPEED control just to the left of the switch click. Press and hold either of the arrow keys until the frequency indicator displays the correct frequency.

With the volume control in your receiver turned up so you can hear receiver noise, press one of the arrow keys. You will notice an increased noise level as the antenna tunes through resonance. The LED array on the front of the LC-2 will light during resonance as well. The noise will peak and subside very quickly.

- The sensitivity of the LEDs can be adjusted by turning the "SENS" knob on the left side. Just beyond the switch click is maximum sensitivity. Further rotation to the right will decrease sensitivity to audio noise. Set this control to about 50% rotation for the initial tests, then readjust it for normal operation: Set the control so that the fourth LED just comes on with the highest "S" meter reading. The setting will vary when you change the audio gain level on the receiver.

After hearing the noise peak, turn the SPEED control to a lower speed and alternate pressing the arrow keys until you arrive at the peak noise point. If you wish to transmit, use lowest possible power and adjust for minimum SWR.

You should be able to realize 1.2 – 1.5:1 VSWR if the antenna is in "free space" - i.e. not in an attic or near a house wall where the VSWR might become 2:1 or worse. However, the net effect of a non-perfect VSWR is to cause some of the power to be lost in the cable. You will find that antenna performance (measured by the ability to hear and be heard), is not very sensitive to VSWR differences — it is much more sensitive to correct tuning. In addition, your transceiver may not "like" the reflected power associated with a high VSWR.

If you have to locate the antenna near metallic objects, you may want to adjust the primary loop closer or farther from the aluminum band for minimum SWR on your favorite frequency. The primary loop is the length of coax located in the small part of the antenna shell, and its position can be adjusted by first separating the two halves of the antenna shell, then moving the primary loop to a different notch.

11. TROUBLESHOOTING AND SERVICE

LOOP CONTROLLER DIAGNOSIS

If the dial light does not light when power is applied, take the cover off the LC-2 and examine the fuse. Replace with a one amp fuse if necessary.

Before applying power after replacing the fuse, check to see if the power cable is polarized properly. The center pin on the power connector should be connected to +12 VDC. The included AC-1 power supply is wired properly.

If the LC-2 power indicator lights, but you do not get any indication that the motor is turning the tuning capacitor in the antenna (as indicated by a series of audible pulsations in the antenna or changes in the receiver noise level), then you will need to take the housing apart to expose the tuning capacitor assembly.

Remove the three 1/4" clamp screws and remove the top half of the housing. (The lower half has drain holes).

Operate the arrow keys on the LC-2 and see that the center part of the tuning capacitor slowly rotates. If the motor doesn't turn, check the continuity of the loop controller cable. If the motor turns, but the capacitor doesn't, the gear may be jammed, loose, or slipping.

RETURN TO FACTORY PROCEDURE

If the IsoLoop must be sent in for repair, we will give you a Return Merchandise Authorization (RMA) number over the telephone. Including this number with your returned items allows us to better track your unit with our computer, so we can tell you its exact status at any moment.

Send your equipment by UPS to our street address — not the post office box number. The street address is:

AEA, Inc.
2006 196th St. SW
Lynnwood, WA 98036
USA

We will need your STREET address for UPS return — be sure to send it.

UPS Brown takes seven to ten working days each way, depending on distance and Blue takes two to three days. Red is an overnight service and is expensive. Send the antenna in a way that it can be traced if we cannot verify receipt of shipment. We suggest UPS or insured postal shipment.

If the IsoLoop is out of warranty, it will be returned by UPS Brown COD unless: 1) It was received UPS Blue/Red in which case it will go back UPS Blue COD cash, or 2) If you designate billing to VISA or MASTERCARD, or 3) you enclose personal check endorsed not to exceed $100, or 4) you specify some other method of return.

Typically, we will service the product in about five working days if we have all the facts. If we must call you, it may take longer. PLEASE, if you send the IsoLoop, include a letter stating the problem and where you can be reached during our business hours. If you can be reached by phone in the evening on the East Coast, let us know the number. Our flat rate for non-warranty service on the IsoLoop is $70, including shipping. AEA is not responsible for damage such as caused by lightning, non-professional alterations, poor storage/handling, etc. See page 12.

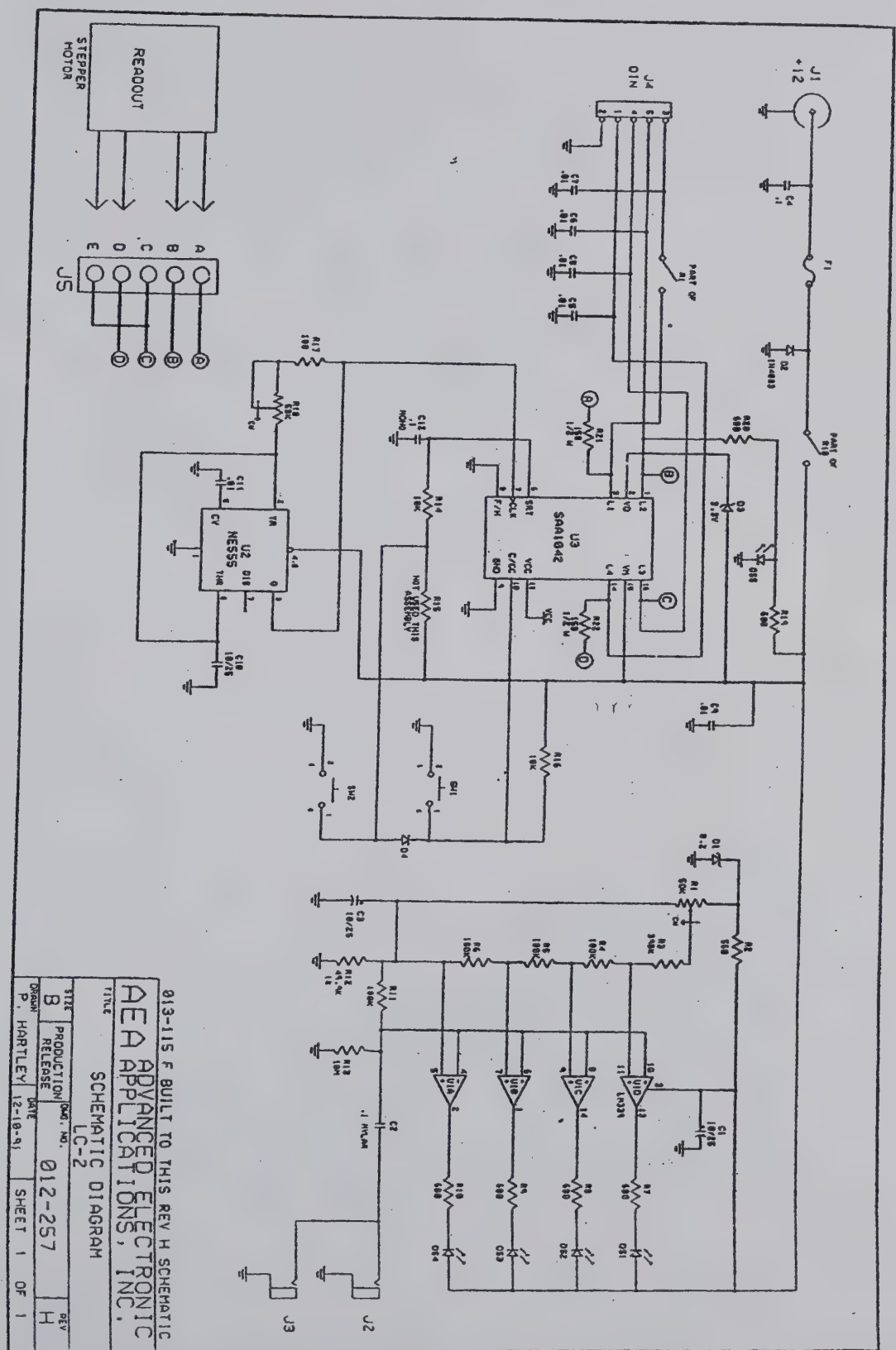
Should your warranty card not be on file at AEA, you need to send proof of the purchase date to receive warranty service. Typically a copy of your bill of sale from an AEA dealer will suffice.

The warranty is for the original owner only and is not transferable.

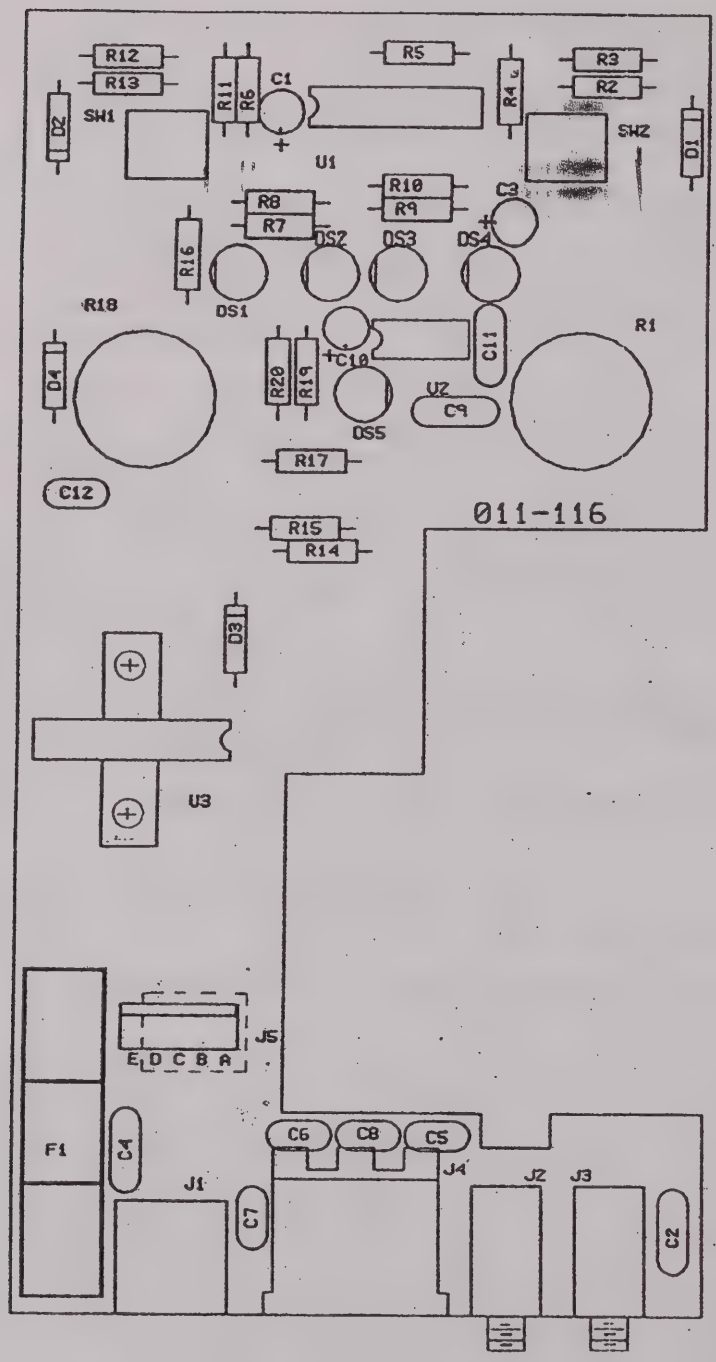
12. PACKING LIST

IsoLoop 10-30 Antenna with U-Bolt, nuts & washers; 50' LC-2 Control Cable
LC-2
AC-1 Power Supply
Worm Clamp
Coax-Seal ® Hand-Moldable Plastic
2-Conductor Audio Cable
Warranty Card

13. LC-2 SCHEMATIC DIAGRAM

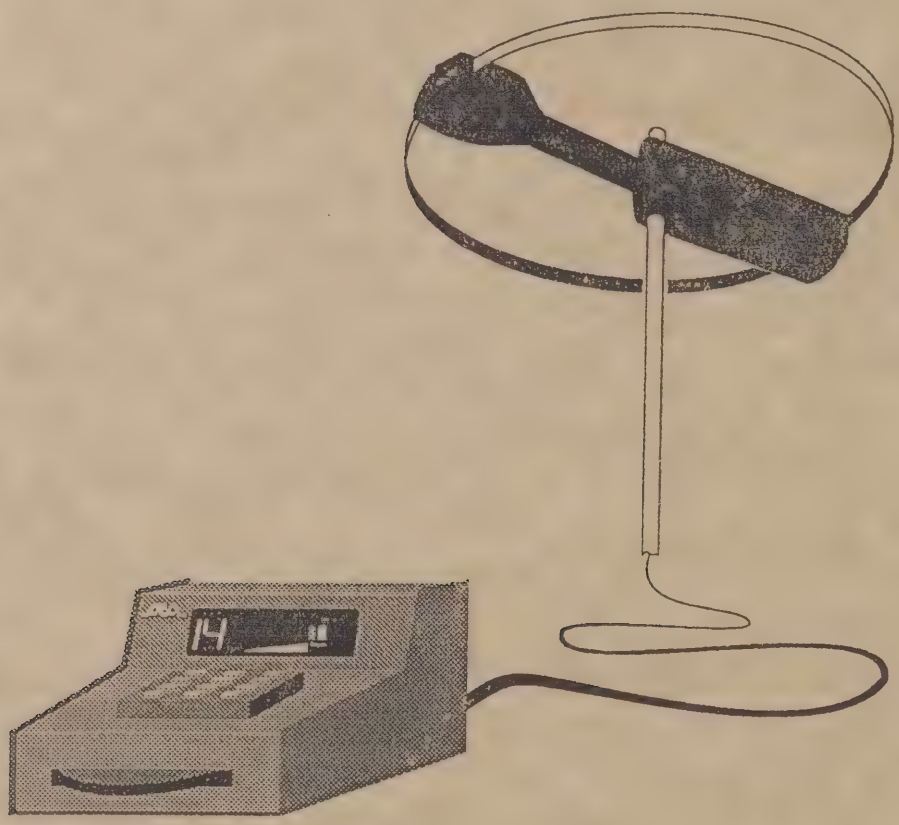


14. LC-2 PARTS PICTORIAL



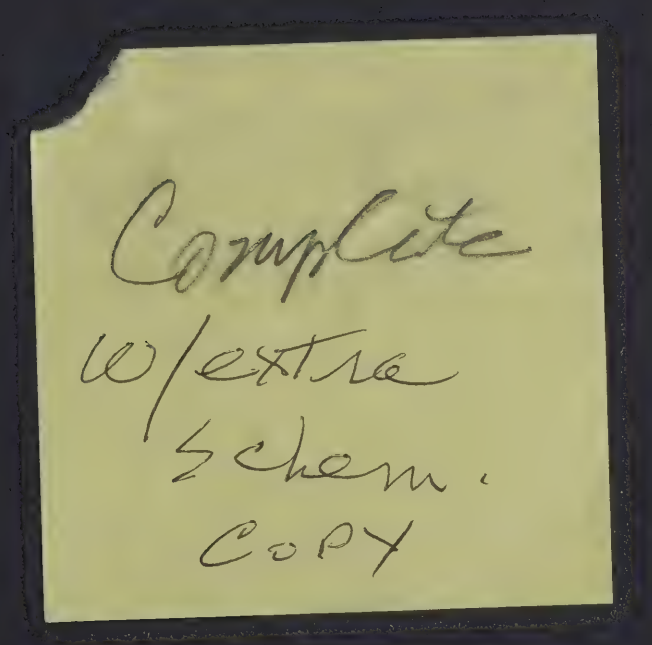
IT-1 IsoTuner

automatic tuner for the IsoLoop 10-30



Operating Manual

AEA Part Number 040-069


Complete
W/extra
Schem.
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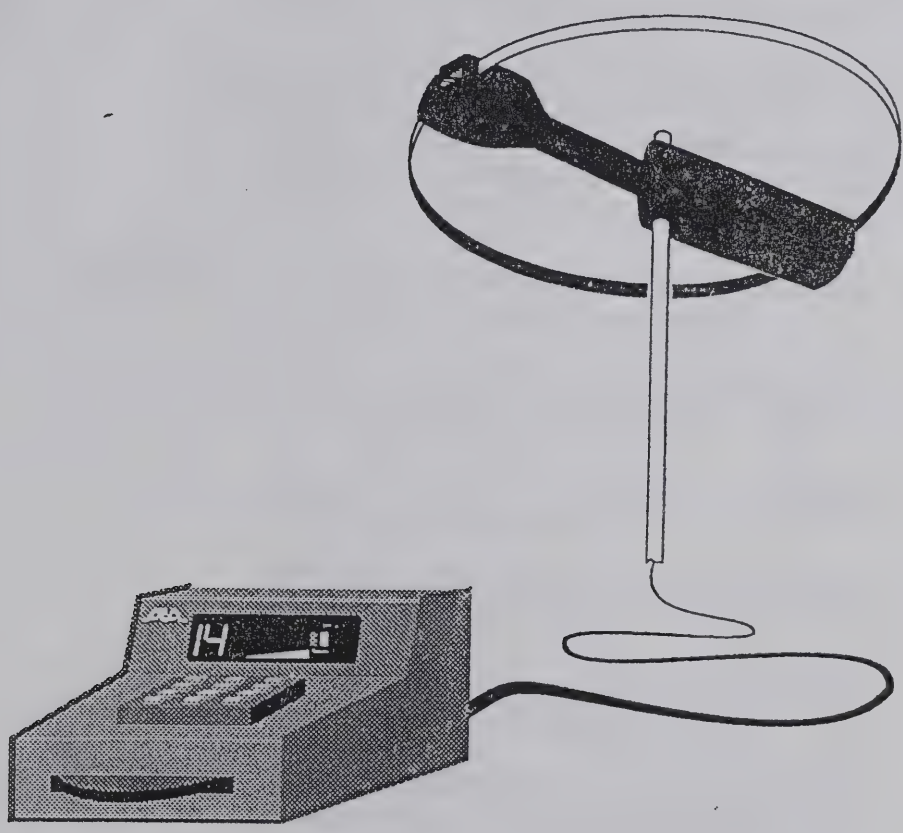
IT-1 IsoTuner

automatic tuner for the IsoLoop 10-30



Operating Manual

AEA Part Number 040-069

Introduction

Congratulations on your purchase of the IT-1 Iso-Tuner. The IT-1 is the finest IsoLoop tuner available. It makes the IsoLoop 10-30 HF antenna one of the easiest-to-use multi-band antennas you'll ever own.

Please take a few minutes to read through this manual to familiarize yourself with the IT-1's operation. Although the IT-1's functions are intuitive and easy to use, this manual contains good hints and tips to help you get the most out of your IsoLoop antenna system.

Features

- Thumbwheel knob for manual tuning. Step rate determined by speed of knob rotation.
- 12-button keypad with audible beep. Beeper also announces completion of tuning and error conditions.
- Automatically tunes for either maximum received noise or minimum SWR.
- Eight frequencies (IsoLoop capacitor positions) may be memorized and quickly recalled.
- A 10-segment LED bar monitors tuning process and indicates selected memory number.
- A numeric display indicates tuned frequency to the nearest megahertz and displays error codes.
- Memory is retained during power outages.
- Built-in serial computer interface for remote/computer control. Pop-up software for IBM compatible computers is included.

Specifications

Autotune Power Range:	5 to 50 Watts typical
Autotune Time:	7 seconds worst-case 2-4 seconds typical
Number of Memories:	8
Tuning Modes:	Manual: Multi-speed thumbwheel Automatic: Peak noise, Null SWR
Displays:	Frequency Selected memory number Relative noise Relative SWR Tune mode
Microprocessor:	80C51
RS-232 (9600 baud):	Duplicates front panel functions Can access noise level, FWD and REF voltages, frequency, step number, memory number
Included PC Software:	Pop-up allows control and displays status
Weight:	2 lbs, 7 oz (1.1kg)
Dimensions:	4-1/8"H x 6-3/8"D x 5-1/8"W (10.47cm x 16.19cm x 12.3cm)
Power Requirements:	12–16 VDC @ 700 mA

Setup

Preparation 1) Plug the power cube that came with your IsoLoop into a 120 VAC outlet and connect the cube's plug to the POWER connector on the IsoTuner. The frequency display will indicate either a two-digit number or '- -' for a few seconds, then the unit will turn off. (If memory was lost, the LEDs will also sequence.) The unit normally turns itself off when not being used. Pressing the * button will turn it on again.

2) Plug the 5-pin DIN connector on your IsoLoop cable into the ISOLOOP connector on the IsoTuner.

3) Insert the directional coupler in series with the coaxial cable to your IsoLoop, paying attention to the markings on the cover of the coupler.

4) Use the cable supplied with the IsoTuner to connect the directional coupler to the DIR. COUPLER jack on the IsoTuner.

5) Using the cable that was supplied with your IsoLoop, connect your transceiver's speaker output to the SPEAKER IN jack on the IsoTuner, and connect your speaker to the SPEAKER OUT jack.

6) If you will be using the IsoTuner with a computer, connect an appropriate cable (not supplied) between your computer's serial port (COM1, 2, 3, or 4) and the RS-232 connector on the IsoTuner. (One suitable cable is Radio Shack's #26-117.)

Calibration Make sure the IsoLoop's control cable is connected to the IsoTuner. When the IsoTuner is plugged in, the two digit frequency display may indicate '- -'. This means it has lost calibration. (Calibration and stored settings are retained during a power loss of up to several hours.) To calibrate the IsoTuner, use the knob to tune the loop to some known frequency. Then press and hold the * button while turning the knob until the display indicates the selected frequency.

NOTES:

1) *When turning the knob slowly, it will take one or more revolutions to change the display by 1 MHz. This allows fine adjustment of the frequency to which the IsoLoop is tuned. For example, when properly calibrated, the display will change from 14 to 15 when the resonant frequency is 14.5 MHz. Therefore, a display of 14 means that the resonant frequency is closer to 14 MHz than to 13 or 15, as illustrated below.*

   Display reads: —12— | —13— | —14— | —15—
   Resonant freq.: 12.0 12.5 13.0 13.5 14.0 14.5 15.0

2) *To aid with interpolation within each MHz range while calibrating, one of the numbered (green) segments of the LED bar will be lighted. For example, when calibrating at 14.0 MHz, the frequency display will read 14, and one of the center green segments should be lighted.*

There are four resonance points per revolution of the variable capacitor in the IsoLoop. Although the display now reads correctly, the capacitor may be closing (decreasing frequency) when the IsoTuner thinks it is opening. Therefore, you must check resonance on another frequency to make sure the IsoTuner and IsoLoop are in sync. Before doing so, press 1 * to save

the current position in memory 1. Then QSY(tune) up or down about 1 MHz, and re-tune the IsoLoop using the knob. Note whether the display changed in the same direction you QSY'd. If so, calibration is complete. If not, press **1 #** to return to the saved position, and then press **9 9 ***. (**9 9 *** reverses the IsoTuner's sense of direction.) Calibration is now complete.

NOTES:

1) *If a frequency near 10 or 30 MHz is used for calibration, it may not be obvious that one of the incorrect resonance points was chosen, since the display will only be off by a small amount. For this reason, it is best not to calibrate on the 10 or 30 meter bands.*

2) *Calibration should be performed prior to using the STORE function, since calibration will alter the correspondence between stored values and actual positions. For the same reason, recalibration should be avoided unless it is required for proper operation.*

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Operation

Manual Tuning

Manual tuning is accomplished using the thumbwheel. When the knob is turned slowly, the stepper motor in the IsoLoop steps 24 times per knob revolution, facilitating fine tuning. Faster rotation results in more steps per revolution. The internal transducer clicks once on each step to aid in judging the rotation rate of the capacitor. Refer to OPTIONS in the appendix to disable these clicks or the multiple-speed tuning feature.

Depending on whether you are receiving or transmitting, the eight green LED bar segments will indicate relative noise (yellow **Noise** LED is on) or relative SWR (red **SWR** LED is on) as you turn the knob.

Once calibrated, the IsoTuner is able to coarse-tune to the nearest resonant position for a given frequency, without monitoring noise or SWR, by means of an internal look-up table. You will probably want to take advantage of this before manually fine-tuning. If so, enter the desired frequency to the nearest MHz, then press *****. The IsoTuner will beep once when the coarse tuning is complete.

As an example, if you press **1 4 ***, the IsoLoop will tune to the center of the 14 MHz segment and should be resonant at approximately 14.0 MHz.

NOTES:

1) *As you enter digits, they will appear in the MHz display. Once you press * or #, the MHz display will again show the frequency.*

2) *If you enter a frequency below 10 or above 30, or if the IsoTuner has not been calibrated yet, it will beep twice and display* **Er** *(error).*

Automatic Tuning

To use the auto-tune features, adjust audio level or transmit power *(see note 2, below)* and press **#**. If transmitting, the IsoTuner tunes for minimum SWR. If receiving, it tunes for maximum noise. The red **SWR** or yellow **Noise** LED turns on to indicate the mode being used. In SWR mode, the IsoTuner automatically compensates for transmit power levels between approximately 5 and 50 watts. Noise mode should work properly for normal listening levels; a rear panel adjustment allows setting this range. When tuning has completed the IsoTuner beeps once. Pressing **'*'** aborts the tuning process.

Once calibrated, you may speed up the tuning process by entering the desired frequency to the nearest MHz before pressing **#**. For example, if the desired frequency is 28.8 MHz, press **29 #**. The IsoTuner will quickly coarse tune to the nearest resonant point, then fine tune by looking for maximum noise or minimum SWR as described above. (The tuning mode won't be displayed until the fine tune process begins.)

NOTES:

1) *If you enter a frequency below 10 or above 30, or the IsoTuner has not been calibrated, it will beep twice and display* **'Er'** *(error).*

2) *If tuning for minimum SWR, CW mode should be used and transmit power should not be changed during the tuning process. (The lowest power that allows proper tuning should always be used.) If tuning for maximum noise, the audio level should not be changed until tuning is complete.*

When tuning for SWR, the frequency display will show an error code accompanied by two short beeps if it finds the power level outside its adjustment range. HP means the power is too high; LP means the power is too low. If an error occurs, re-adjust the transmit power and try again. You may ignore the error code if you are tuning manually, but the LED bar will not be useful in tuning for minimum SWR if the level is out of range.

When tuning for noise, your transceiver's volume control should be set so that one or two segments of the LED bar are lighted when the antenna is out of resonance. A rear panel control is provided for setting the noise gain so that this is the case at normal listening levels. (Refer to ADJUSTING NOISE GAIN in the appendix for adjustment instructions.)

NOTES:

1) *If all the green 'level' segments of the LED bar are unlit, once the IsoLoop is tuned for minimum SWR the SWR is below approximately 1.1:1. (See the SWR CHART in the appendix.)*

2) *If you have an external SWR bridge, it may prove to be more accurate and easier to use for manual tuning than the LED bar.*

Storing Positions

Eight positions may be stored and recalled for even faster operation on often-used frequencies. To store a position, press a digit button (1 - 8), followed by *. To return to a stored position, press the appropriate digit button, followed by #. When the recalled position has been reached, a short beep will be heard. (If a memory is empty, trying to recall it will result in an error code NS {nothing stored}, accompanied by two short beeps.) Pressing '*' aborts the recall function.

NOTES:

1) *The IsoTuner will display* **Er** *(error) and beep twice if you try to store to (nonexistent) memory 0 or 9, or try to recall from memory 0.*

2) *Pressing* **9 #** *does not attempt to recall memory 9. It is a special function to turn the IsoTuner off immediately, without waiting for it to time out.*

When storing or recalling a position, the LED bar segment corresponding to the selected memory will turn on. (Tuning the IsoLoop after using **Recall** alters the recalled position, so the segment representing the previously-recalled memory will turn off.)

General Information

The LED bar is also used to indicate relative noise or SWR (depending on the mode) during automatic or manual tuning. Shortly after tuning is completed, the LED bar reverts to its normal function of displaying the recalled memory number (which at this point will be none). After this occurs, the next movement of the knob causes the tuning mode (noise or SWR) to be re-determined and the noise or SWR to be displayed. In SWR mode, the LED bar will also be re-scaled as appropriate for the transmit power being used.

Eight seconds after performing a function, the microprocessor de-energizes the stepper motor, turns off the LEDs, and goes into a power-down mode. Negligible power is consumed in this mode and since the microprocessor's clock is stopped, no digital noise or birdies are generated. This also avoids detuning if the knob is accidentally bumped. Tapping the * button turns the unit back on without performing any function.

The '*' button may be used to abort a recall or tune function in progress. Also, when tuning manually in

SWR mode, pressing this key re-scales the LED bar. (Don't turn the knob while the * button is pressed, as calibration will be lost.)

NOTES:

1) *The turn-off delay can be increased or decreased. Refer to OPTIONS in the appendix.*

2) *Whenever you enter a wrong digit or digits, simply enter the desired digits before pressing * or #. (If storing or recalling, enter* **0** *then the memory number. For example, if you want to recall memory 5 and you press* **4** *by mistake, enter* **0 5 #**.)

3) *If you start to enter a function, then change your mind, you can escape in one of four ways:*

   a) *Wait for the IsoTuner to turn off.*

   b) *Press* **0 9 #** *to turn the IsoTuner off.*

   c) *Press* **0 0 *** *and ignore the error indication.*

   d) *Turn the knob.*

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Computer Interface

The included serial interface allows computer control of your IsoLoop. The baud rate is fixed at 9600. Available functions are outlined below:

NOTE:

1) *Characters enclosed in single quotes below are ASCII characters. For example, 'f represents the value 66 hex. (Lower case must be used.) Numbers following functions refer to chart on next page.*

ASCII char(s)	Function
'*'	Abort Tune or Recall function (2)
n'*'	Store current position in memory n (n is '1' - '8') (2)
nn'*'	Coarse tune to nn MHz (n is '10' to '30') (1,2)
'#'	Tune (same as # button with no digits) (1,3)
n'#'	Recall position stored in memory n (n is '1' - '8') (1,3,6)
nn'#'	Fine tune to nn MHz (n is '10' to '30') (1,3)
'+'	Rotate clockwise one step
'-'	Rotate counter-clockwise one step
'>'	Rotate clockwise ten steps
'<'	Rotate counter-clockwise ten steps
'f'	Get frequency in MHz (returned as packed BCD)
's'	Get forward, reflected bridge values (two bytes)
'n'	Get averaged noise value (0 - 255)
'p'	Get binary position (0 - 1F3F hex; high byte first) (4)
'g'	Get current SWR bridge amplifier gain (1 - 5)
n'g'	Lock bridge amp gain at n (n is '1' - '5') (5)
'11!'	Disables auto-off feature (7)
'99!'	Invalidates memory (next power-on will run initial tests)
ESC (1BH)	Turn off

(1) An ASCII bell character (07 hex) is returned on completion.

(2) The space character (20 hex) may be used in place of '*'.

(3) The carriage return character (0D hex) may be used in place of '#'.

(4) When this value is between 0000 and 07CF or between 0FA0 and 176F, the + and > characters will cause an increase in the antenna's resonant frequency. Otherwise, they will decrease resonant frequency.

(5) The gain is not actually changed to this value until the 's' command is issued to measure the forward and reflected values.

(6) If the requested memory is empty, no bell character will be returned to signal completion.

(7) Turning the unit off re-enables auto-off.

NOTES:

1) If the unit has powered down, the first character received at the serial port will turn it back on, but that character will be lost. One way to ensure that the unit is on before sending a command is to send a character that is not in the above list (so it will be ignored if the unit is already on), wait approximately one second to allow for initialization, then send the command.

2) The application program must allow reasonable time for completion of commands that do not either return a value or signal completion with the ASCII bell

character. For example, the < and > commands may take a few tenths of a second to execute.

3) *Error conditions are reported by means of the following characters:*

E - *Lost calibration or invalid memory number.*
N - *Nothing stored in recalled memory number.*
L - *Power is too low to tune for minimum SWR.*
H - *Power is too high to tune for minimum SWR.*

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Appendix

Options Some parameters may be changed to suit user preference. To change one of these parameters, you must first wait for the IsoTuner to turn off (or turn it off by pressing 9 #). Then hold down the specified digit key while pressing the '*' button. The IsoTuner will acknowledge the change with a beep, but will not turn on.

Example: To reset all parameters to their default conditions (with the IsoTuner off) hold down the '8' button and press '*'.

To change the default eight second turn off delay, use the '4' button to decrease it by one second (to a minimum of 1) or the '6' button to increase it (to a maximum of 15). (You can use the '5' button to reset it to its default value of 8 seconds.)

To turn off the keypad beep, use the '1' button. Use it again to turn the beep back on.

To turn off the click that occurs with each step of the motor in the IsoLoop, use the '2' button. Use it again to turn the click back on.

If you don't care for the feature that causes the thumbwheel to generate more steps per turn as it is turned faster, use the '3' button. To re-enable that feature, use the '3' button again.

SWR Chart The following chart gives nominal SWR values corresponding to LED bar level indications when tuning for minimum SWR.

								1.0 <= SWR < 1.1
▮								1.1 <= SWR < 1.3
▮	▮							1.3 <= SWR < 1.5
	▮							1.5 <= SWR < 1.7
	▮	▮						1.7 <= SWR < 1.9
		▮						1.9 <= SWR < 2.2
		▮	▮					2.2 <= SWR < 2.6
			▮					2.6 <= SWR < 3.0
			▮	▮				3.0 <= SWR < 3.6
				▮				3.6 <= SWR < 4.4
				▮	▮			4.4 <= SWR < 5.5
					▮			5.5 <= SWR < 7.1
					▮	▮		7.1 <= SWR < 9.9
						▮		9.9 <= SWR < 15.5
						▮	▮	15.5 <= SWR < 33
							▮	SWR > 33

Adjusting Noise Gain To properly adjust the Noise Gain control on the rear panel, first adjust your receiver's volume control for a normal listening level with the IsoLoop at resonance. Then, while slowly turning the thumbwheel, watch the LED bar. When the Noise Gain control is adjusted properly, there will be a change of several segments as the IsoLoop is tuned in and out of resonance, and resonance will correspond to about six lighted (green) segments.

Self Test When the IsoTuner is initially powered up, it performs a checksum on its program ROM. In the unlike-

ly event of an error, an error code of Er will be displayed.

After passing the checksum test, the LED segments are tested--the frequency display shows 88, both mode LEDs light, and the remainder of the LED bar segments sequence. Then the firmware version number is displayed briefly (eg. -1).

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Circuit Description

Controller 8-bit microcontroller U1 scans the keypad, monitors the thumbwheel, reads the A/D converter, provides the serial port, steps the motor, generates tones, and sends data to the displays.

Shaft Encoder The thumbwheel has stripes that alternately reflect and absorb infrared radiation, causing IR emitter/sensors DS1 and DS2 to produce pulses as the wheel is rotated. The pulses are 90 degrees out of phase with each other, allowing the microcontroller to determine the direction of rotation. U1 pin 12 is an external interrupt input. Each time this pin goes low, an interrupt routine looks at pin 2 to see if it is high or low to determine direction. Hysteresis due to Schmitt triggers Q4/Q5 and Q6/Q7 avoids extraneous pulses.

Keypad The keypad is scanned by taking the three column lines low one at a time, and checking to see if any of the four buttons in that column are pressed. After the IsoTuner has turned off, it can only be 'awakened' by a master reset (pin 9 going high). A high on pin 39 normally keeps Q12 off via D8. Only the left column of the keypad is low when the unit is off, so that only the * button will allow D8 to be back-biased, causing Q12 to turn on, resetting U1.

Serial Port Q8 and Q9 provide an interface between RS-232 levels and the TTL levels at U1. Since no negative potential is available in the IsoTuner, it is taken from the RS-232 output of the computer or terminal to which it is connected via D6 and C19.

Activity on the serial input resets the unit, waking it up, as follows: U1 pin 27 is high when the unit is on.

Therefore, positive transitions on the serial input cannot turn Q10 on. D9 is forward- biased, keeping Q12 from turning on and resetting U1. When the IsoTuner turns off, U1 pin 27 goes low. Therefore, the positive transition of the start pulse on the first character received will turn Q10 on, turning Q12 on, and resetting U1, which immediately takes pin 27 high again, avoiding further resets.

Displays U8, U9 and U10 are shift-registers, used as LED drivers. This allows the 24 LED segments to be selected using two data and two clock lines. Series resistors limit current.

Audio Stages Op amp sections U4C and D are used to provide a DC level proportional to average noise level. U4D is biased to half the +5 volt supply by R25 and R16, and provides up to 33 dB gain, depending on the setting of rear panel control R13. D3, D4, C10 and C11 form a voltage doubler, with a time constant set by C11 and R20. Voltage follower U4C keeps the A/D from loading the voltage doubler. Resistors R18 and R19 allow the op amp outputs to swing closer to +5 volts than they could on their own. (This results in a non-zero 'noise' reading with no audio input, but dynamic range is improved.)

Bridge Amplifiers U3 and U4A and B allow the forward and reflected voltages from the bridge to be scaled appropriately by U1, depending on transmit power and SWR during the tuning process. U3A and B are CMOS switches, connected to change the gain of U4A and B in binary steps from 1 to 16. Both the Forward and Reflected amplifiers have the same gain at any given time.

A/D Converter U2 is a four channel, 8-bit serial A/D converter. Three of the four channels are used to measure forward and reflected bridge voltages and noise level. U1 selects the channel serially and reads the voltage on that

channel serially. Each time U1 needs the audio (noise) level, it averages sixteen readings, taken at 50 uS intervals.

Motor Driver Stepper motor driver U7 is connected to produce only full steps. The resistance from pin 6 to ground determines the current supplied to the windings. To reduce standby current, Q11 turns off when the unit powers down, adding R47 in series with R46. To rotate the motor, U1 selects the direction via U7 pin 10, then pulses U7 pin 7 once for each step required.

Power Supply Memory backup capacitor C13 charges through R21. If power is lost, C13 back-biases D1, and keeps U1's memory from being lost. D11 raises the output of regulator U6 to 5.5 volts to compensate for the voltage drop across D1.

5 volt regulator U5 provides Vcc for all ICs except U1. If power is connected backwards to J4, D5 will be forward biased, blowing the fuse and preventing damage to the unit.

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ISO.COM - An IsoTuner Utility Program

Included with your IT-1 IsoTuner is a MS-DOS utility program, provided on 5-1/4" and 3-1/2" disks. The program, ISO.COM, will allow you to operate your IT-1 IsoTuner from your computer's keyboard. The program may be either run from the DOS command prompt, or installed as a TSR (Terminate and Stay Resident program), to be popped up when needed.

When the program is run (or popped up), it automatically turns the IsoTuner on, and causes it to stay on until the program is exited (or popped down), at which time the IsoTuner turns off.

The program displays a box with several sections which relate the status of the IsoTuner. These sections are described below.

NOTE:

1) *For the display to appear, your computer must be in a compatible video mode (mode 2 or 3). If it is not, you will still be able to control your IsoTuner from the computer's keyboard, but the pop-up display will not appear. Be sure to press Escape to return to your application program.*

FREQ: The current frequency, as displayed on the IsoTuner. (1)

POSN: The current position of the capacitor in the IsoLoop. This number will be between 0000

and 7999, where 0000 and 4000 correspond to fully-meshed positions. **(1)**

MEM: When a position has just been stored in memory or recalled from memory, this will display the memory number (1-8).

SWR: After being tuned for minimum SWR, this will display that value. (If the SWR is greater than 10, the display will be >10.)

NOISE: After tuning for maximum noise, the noise value will be displayed here. **(2)**

STATUS: This section gives a brief description of the current status of the IsoTuner. It also displays numerical entries made from your PC's keyboard.

(1) When the IsoLoop is being tuned, this display will change to dashes and be updated when the operation is complete.

(2) It is normal for this value to be in the 20-30 range with no audio input.

There are several functions available from the keyboard. These are described below. (Make sure your IsoTuner has been calibrated before running ISO.COM.)

KEY	FUNCTION
Left Arrow	Step counter-clockwise one step
Right Arrow	Step clockwise one step
Down Arrow	Step counter-clockwise ten steps
Up Arrow	Step clockwise ten steps
Space	Reset mode and SWR amp. gain
Enter	Tune without regard to frequency
n Space	Save position in memory n (1-8)
n Enter	Recall position in memory n (1-8)
nn Space	Coarse tune to nn MHz (10-30)
nn Enter	Fine tune to nn MHz (10-30)
Backspace	Refresh display*
Escape	Abort (if tuning) / Turn IsoTuner off and exit

* If the IsoTuner is operated manually, Backspace will cause the program to update the computer display. However, allow the IsoTuner to complete any operation started manually before issuing commands from the PC.

To run the program from the DOS prompt, type ISO <ENTER>. The program assumes that your IsoTuner is connected to serial port COM1. If it is connected to COM2, 3 or 4, type ISO/n <ENTER>, where n is the port number.

To install the program as a pop-up, type ISO/R (or ISO/R/n) <ENTER>, where n is the port number. The program will confirm that it is resident, and remind you of the 'hotkey' combination, which is to hold down both SHIFT keys while typing I.

(Typing ISO/ <ENTER> will display program usage.)

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In Case of Trouble

If your IT-1 doesn't seem to be working properly, please try the following suggestions before sending the unit in for repair.

Power Is your power supply providing 12 to 16 volts DC under load? In other words, is your power supply capable of delivering at least 12 volts while the IT-1 is on? If you're not sure, try another 12 volt power supply. Also, make sure the center pin of your power cable is positive. If it is not, then the IT-1's internal fuse is probably blown. Replace the fuse and rewire the power cable for center pin positive.

Cabling Make sure all cables are securely connected. Check cable continuity with an ohmmeter.

Other An excellent way to test any electronic equipment is to replace different items from your system with ones which are known to work. If you have a friend with an IT-1, try swapping the units. Or, try borrowing a power supply or control cable. In this way, the problem can be pinpointed and solved more quickly.

If you can't seem to solve the problem yourself, please let us try to help you over the phone before sending the unit in. Many of the products we receive for service are in perfect working order when we receive them. Calling us for technical assistance can save you both time and money.

For application and troubleshooting assistance, please call AEA between 8:00am-12:00pm, 1:00pm-4:30pm in Lynnwood, WA. Ask for the Technical Support department. The phone number is (206) 775-7373.

Please have your IT-1's serial number available. We will also need to know the nature of any other equipment connected to the IT-1.

CompuServe AEA also provides technical support for its line of amateur radio equipment by way of your personal computer and modem on CompuServe's *HamNet!* forum. If you are already a CompuServe member, just type GO HAMNET at any CompuServe prompt. For a free introductory CompuServe membership call 1-800-848-8199 and ask for Representative 48.

If you call for assistance, please have the IT-1 and IsoLoop antenna connected and powered on. The technician you speak with may ask you to perform certain functions to aid in diagnosis. If you have a voltmeter, you might have the IT-1 open so you can report measurements to the technician.

If the unit must be sent in for repair, we will give you a RMA (Return Merchandise Authorization) number for the repair. Please write this number on the outside of the package before sending it in. This number allows us to track the unit and process the repair as quickly as possible.

Advanced Electronic Applications, Inc.
2006 196th St. SW
Lynnwood, WA 98036
(206) 775-7373

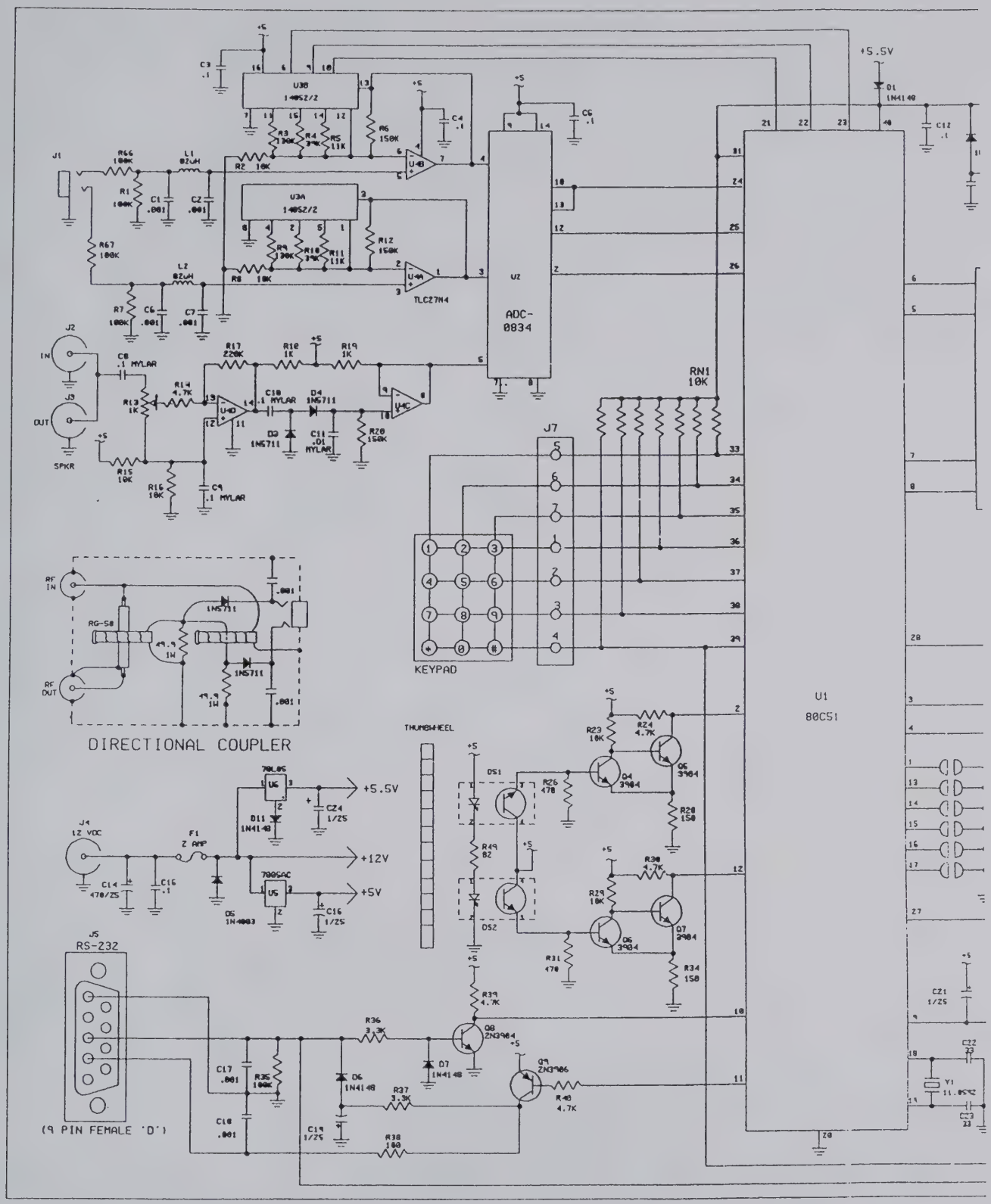
Limited Warranty

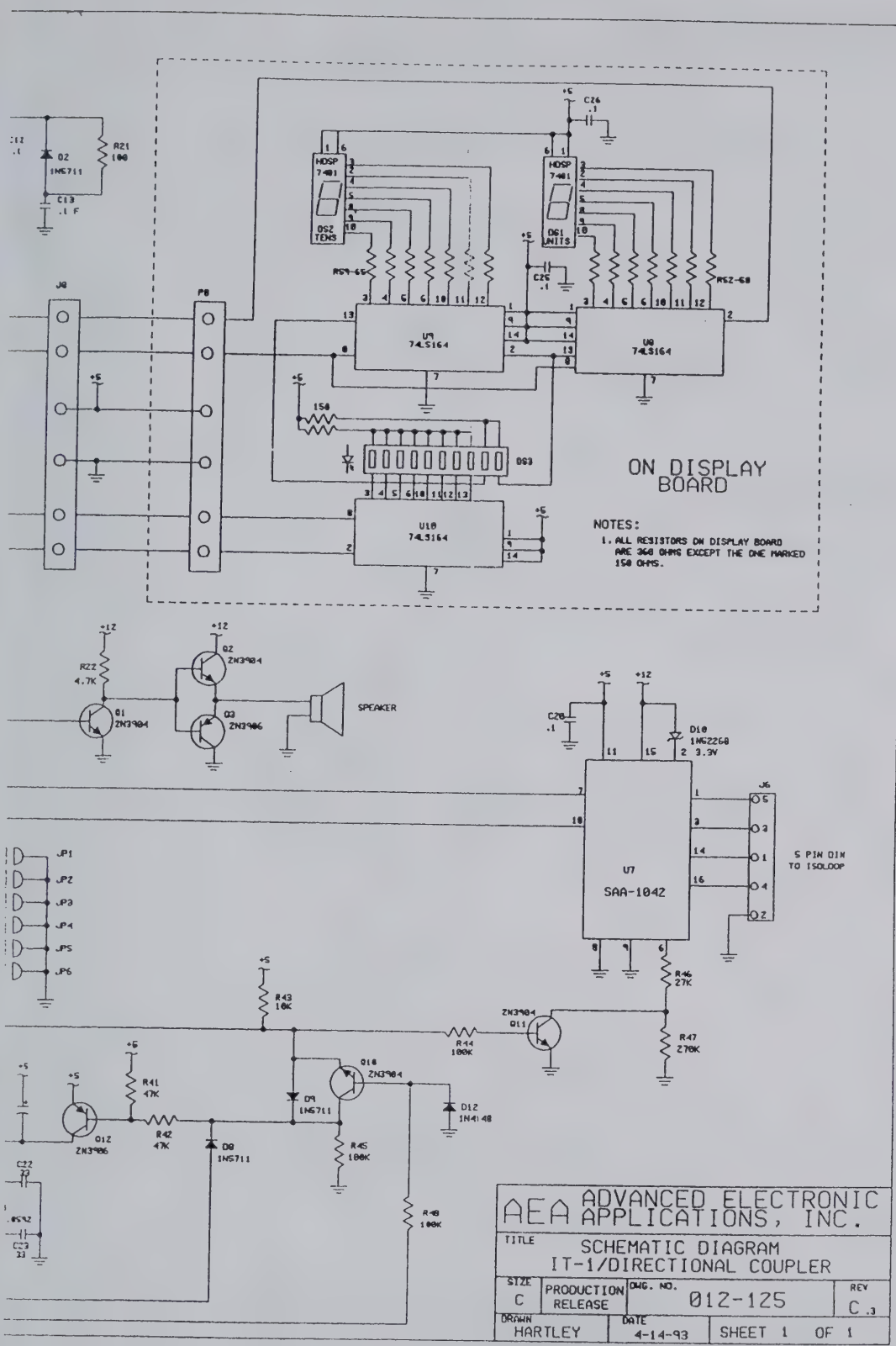
ADVANCED ELECTRONIC APPLICATIONS, INC. warrants to the original purchaser that this product shall be free from defects in material or workmanship for one year from the date of original purchase. In order to obtain warranty service: 1) Complete and mail the warranty registration card within 10 days to Advanced Electronic Applications, Inc., and 2) Send written notification to the address below or telephone as soon as possible after discovering a possible defect:

Advanced Electronic Applications, Inc.
Attention: Service Department
2006-196th St. S.W.
Lynnwood, WA 98036
(206) 775-7373

The written notification must include a copy of the invoice. Include a description of the defective part or condition, with details of the electrical connections to associated equipment and list such equipment. Please enclose your name, phone number, and address. Shipping charges for any parts or units submitted for replacement under this warranty must be paid by the purchaser.

Correct maintenance, repair and use are important to insure proper performance from this product. Carefully read the Instruction Manual. This warranty does not apply to any defect AEA determines is caused by 1) Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specification of the original parts; 2) Misuse, abuse, neglect, or improper installation; 3) Accidental or intentional damage. The field installa-

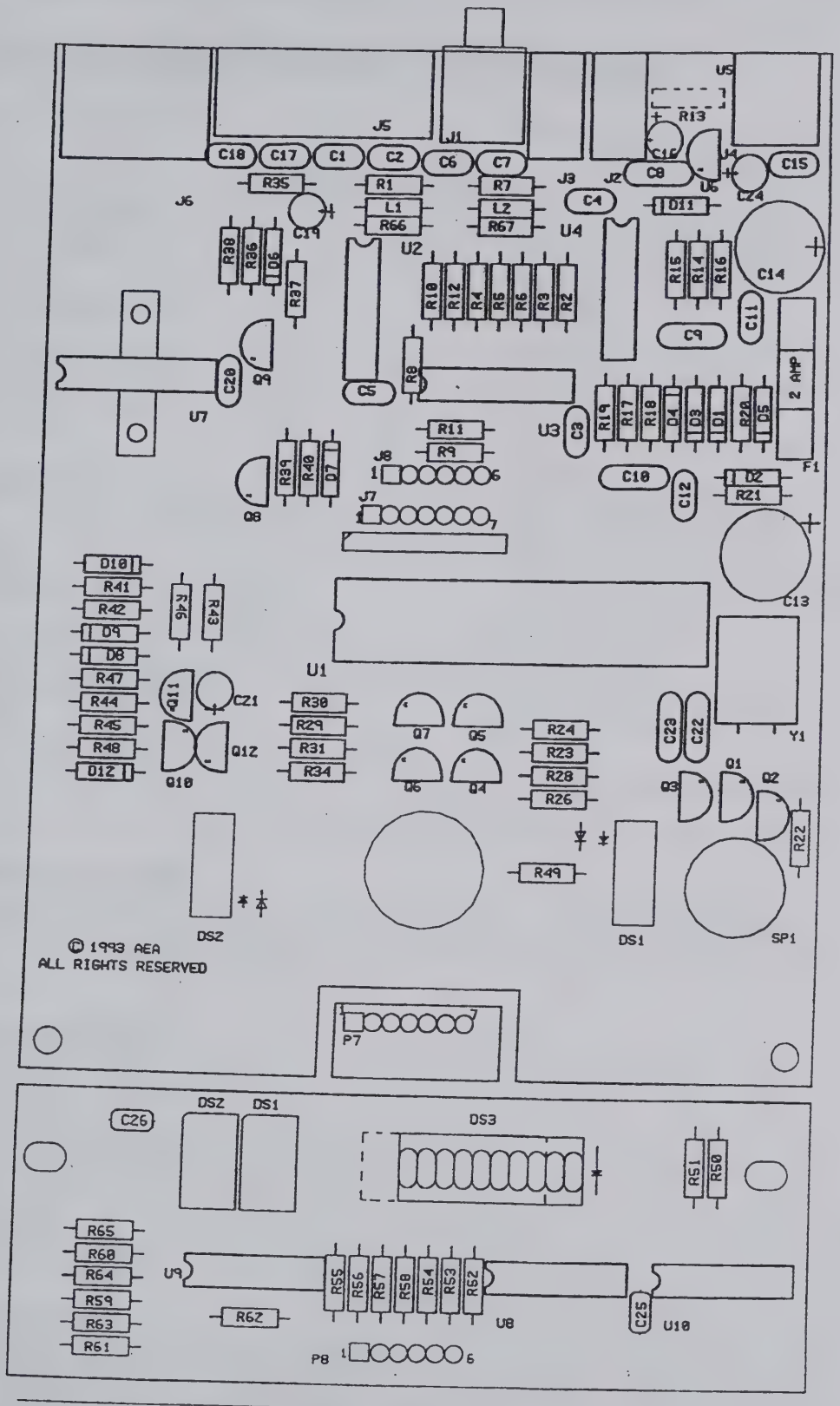

+5.5V
U1
80C51
ADC-
0834
TLC27M4
RN1
10K
KEYPAD
THUMBWHEEL
DIRECTIONAL COUPLER
RF IN
RF OUT
RG-58
1N5711
49.9
1W
RS-232
(9 PIN FEMALE 'D')
12 VDC
2 AMP
+12V
+5V
SPKR
IN
OUT
2N3904
1N4148
78L05
7805AC



AEA ADVANCED ELECTRONIC APPLICATIONS, INC.

TITLE	SCHEMATIC DIAGRAM IT-1/DIRECTIONAL COUPLER		
SIZE C	PRODUCTION RELEASE	DWG. NO. 012-125	REV C .3
DRAWN HARTLEY	DATE 4-14-93	SHEET 1 OF 1	

Parts Pictorial



ADVANCED ELECTRONIC APPLICATIONS, INC.

IsoLoop Antenna Product Comparison

Features	AEA IsoLoop	MFJ 1786	IsoLoop Benefit
Separate DC and Coax feedlines to antenna	Y	N	No RF feedback into DC, better tuning
Stepper Motor control of capacitor	Y	N	Less backlash, better tuning without noise
Direct link coupled feedline	Y	N	Prevents TX power loss of up to 10%
All Aluminum used in construction is irridited	Y	N	Better corrosion prevention
Flexible loop element	Y	N	Does not restrict attic access in most cases
UV resistant antenna housing	Y	N	Crack resistant housing means better protection
Stainless Steel hardware used throughout	Y	N	Better protection against corrosion
Antenna accepts 2 1/4" mast	Y	N* (1 1/4")	Antenna can be installed in a wider range of installations
CW Sweepstakes Winner 11/93 Low Power Category	Y	N	Proven Performance and Capability Record
Flat loop design	Y	N	More outer surface for less resistance to RF
Injection Molded Casing	Y	N	Reduces swelling & warping in extreme conditions
Large capacitor (10,000 volts)	Y	N	Withstands higher voltages, therefore antenna can be higher Q and more efficient
Efficiency Q	High	Medium	More power radiated
Fully Automatic Transmit or Receive Tuner Available	Y	N	Provides quick and convenient loop tuning
Manual tuner included	Y	Y	Allows users to accurately tune loop with no RF feedback.
Retail price	$389.00	$269.95	A higher performing antenna that will endure the elements over time.

Why the IsoLoop 10-30?

With all the Deed Restrictions, Antenna Covenants, and Ordinances in today's housing industry, there is a need for a compact, HF antenna that can fit just about anywhere without being conspicuous to the neighbors, while meeting all codes.

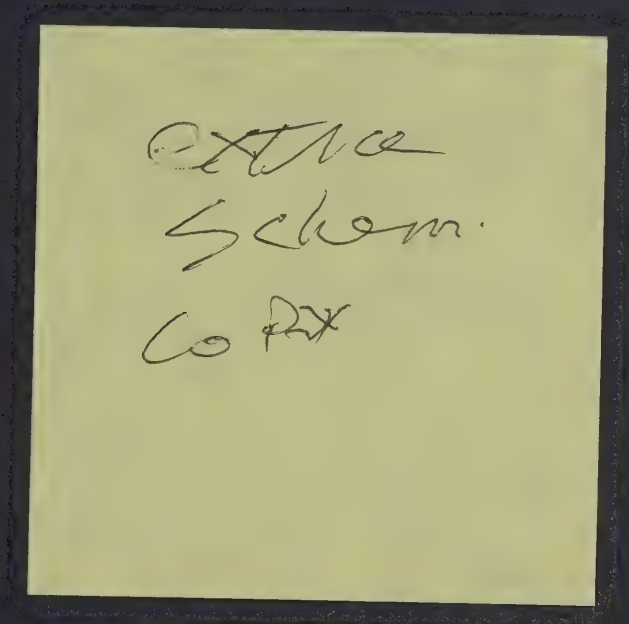
No Restrictions Here!

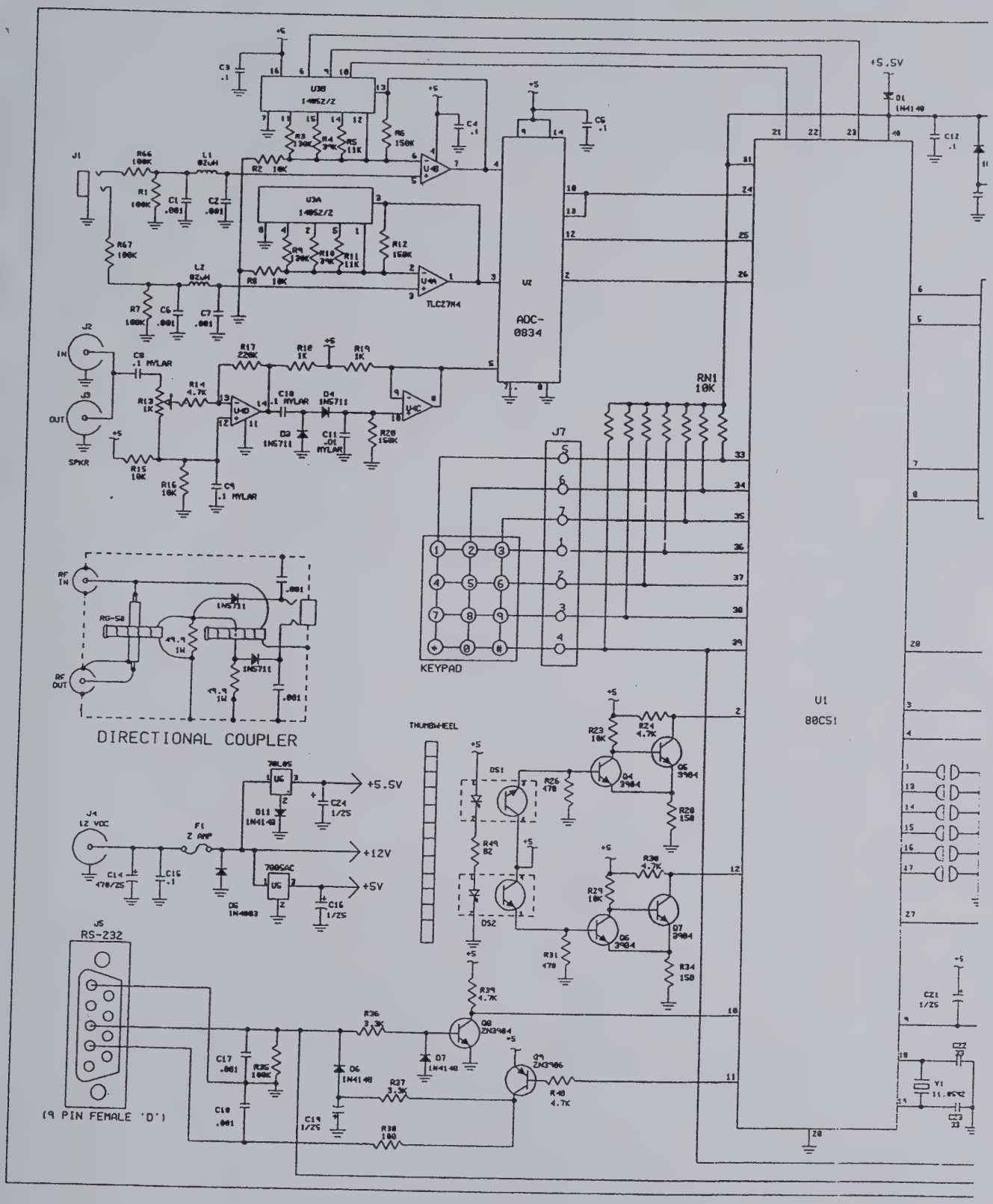
1. No heavy duty tower necessary.

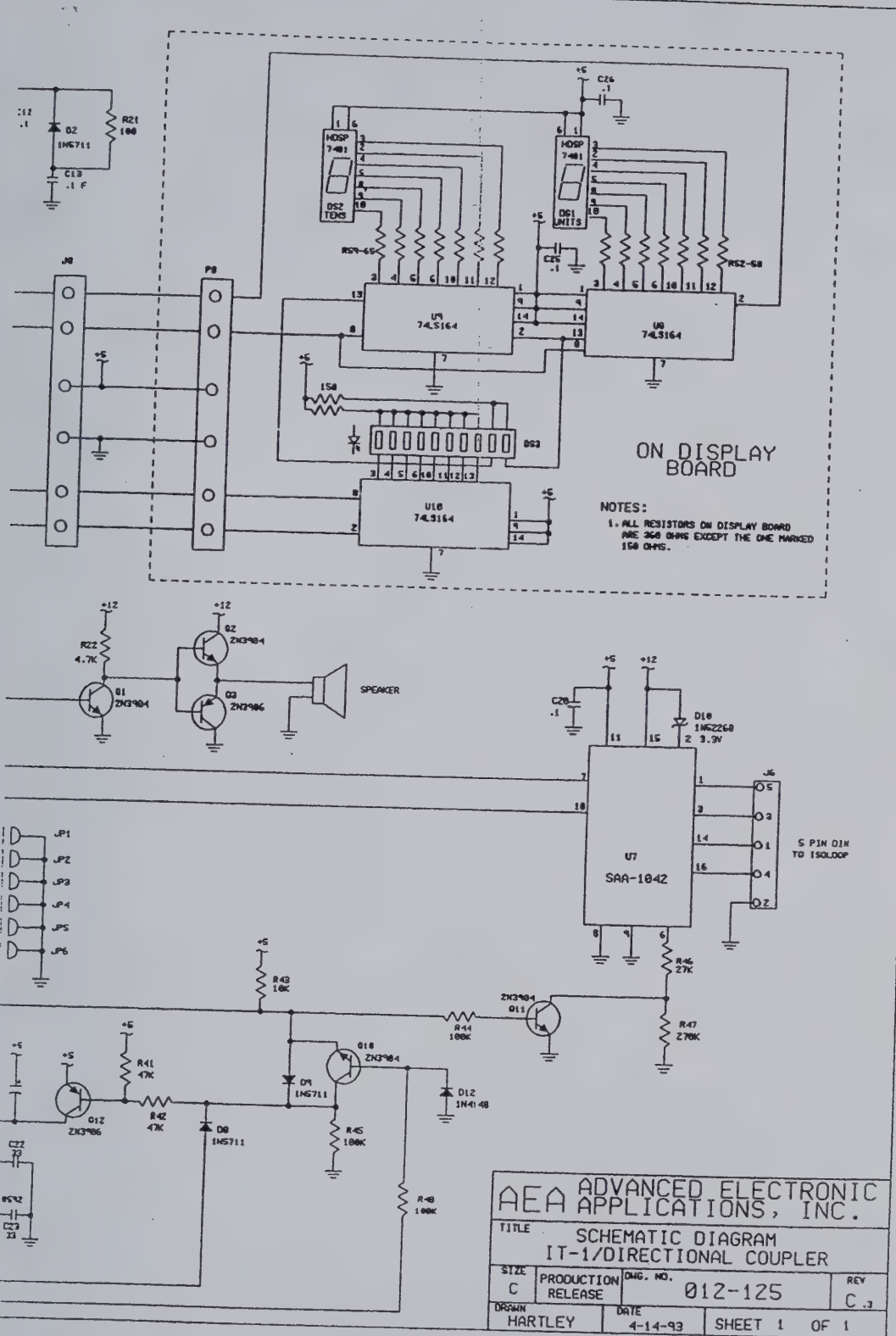
a. No guy wires
b. No building permits
c. No engineering studies
d. No concrete
e. No rotator
f. No ground radials

2. Installation flexibility.

a. Flexible loop allows for easy attic installation
b. Mount it on an RV or car and go mobile
c. Lightweight (14lbs.) allows you to take to Field Day
d. Mount it on your patio or balcony
e. Put it in a tree (It's been done!)


extra
Sclom.
Co Rx


+5.5V
U2
ADC-0834
U1
80C51
RN1
10K
KEYPAD
J7
DIRECTIONAL COUPLER
RF IN
RF OUT
RG-58
THUMBWHEEL
RS-232
(9 PIN FEMALE 'D')
+5.5V
+12V
+5V
TLC27M4


ON DISPLAY BOARD
NOTES:
1. ALL RESISTORS ON DISPLAY BOARD ARE 360 OHMS EXCEPT THE ONE MARKED 150 OHMS.
SPEAKER
5 PIN DIN TO ISOLOOP
SAA-1042
ADVANCED ELECTRONIC APPLICATIONS, INC.
SCHEMATIC DIAGRAM
IT-1/DIRECTIONAL COUPLER
012-125
HARTLEY
4-14-93
SHEET 1 OF 1

by Jeffrey Sloman NIEWO

The AEA IsoLoop™ 10-30

A big antenna in a small package.

Advanced Electronic Applications, Inc.
P.O. Box C2160
2006 196th St. S.W.
Lynnwood WA 98036-0918
Telephone: (206) 774-5554
Price Class: $349

Can a two-inch aluminum band a little over three feet in diameter work as anything more than a dummy load on HF? The textbooks say it can, and AEA has proven it with the new IsoLoop 10-30. Loop antennas have been in use from the beginning of radio, but practical loops for use at HF frequencies face several engineering problems and real world limitations that AEA has managed to overcome.

The IsoLoop is a 43-inch aluminum loop, with a center portion—made of UV resistant, injection molded high density polyethylene—shaped roughly like a dumbbell. In the center of the dumbbell section is a hole designed to accept a mast up to two inches in diameter, along with stainless steel hardware for clamping the antenna in place. A stainless steel hose clamp is provided for mounting the antenna radially, for use from, say, a balcony railing. The stainless U-bolt is also needed, and it is a minor inconvenience that the antenna housing must be disassembled—three hex bolts with nylon-retained aircraft nuts—to remove it from its default center position.

In the larger end of the dumbbell is a 10,000-volt split-stator capacitor. The two ends of the irradiated aluminum band that makes up the loop are welded to the two halves of the capacitor's stator. This one-piece design is very rugged, its only downside being the need to deform the loop to fit it into a UPS-shippable box. It takes some work to get the loop round again after unpacking it, though it need not be perfectly round to operate perfectly. If you are like me you will want the loop to be round for aesthetic reasons. Also in this end of the housing is a precision stepper motor and gear train for remote control of the capacitor's tuning.

On the smaller end of the dumbbell is a one-turn electrostatically shielded loop made of coaxial cable. This shielded coupling loop matches the extremely low impedance—less than 1/10 ohm—of the radiating loop to the 50-ohm feedline. It also acts as a balun which isolates the feedline from the antenna—the effect that gives the IsoLoop its name. The input to the antenna is through a supplied right angle PL-259 adapter which helps to route the coax at a 90 degree angle to the antenna. The antenna must be mounted with the SO-239 connector facing down, along with the drain hole also located on this side.

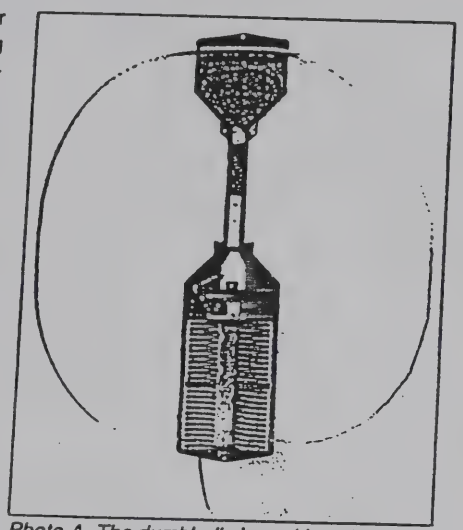


Photo A. The dumbbell shaped housing of the IsoLoop contains a 10,000-volt split-stator capacitor, a stepper motor, and a one-turn loop for impedance matching.

Also in the package are the LC-2 controller—for tuning the antenna—and its 12-volt wall mount transformer power supply. The LC-2 is a small beige box with two thumbwheel controls, two push-button switches, and four LEDs. The left-side control—marked SENS—adjusts the sensitivity of the LED audio level indicators; I'll explain these later. The control on the right—marked SPEED—adjusts the pulse rate of the signal sent to the stepper motor located in the antenna, which adjusts the tuning speed. The push-buttons control the direction of the capacitor's travel. On the back of the LC-2 are jacks for power (standard coaxial), the stepper motor (5-pin DIN), and the audio in/out (1/8 phone).

New and Improved

This IsoLoop is the new and improved version of the original IsoLoop 14-30 antenna introduced in 1990. *[Ed. Note: See the review of the original antenna in the September 1990 issue of 73, p. 10.]* The original had an operating range of only 14-30 MHz; AEA has added 4 MHz to the low end to cover the 30 meter band. The original used aluminum tubing and required assembly. This design was prone to loss from bad connections of the tubing sections to each other and the capacitor. The older model used a belt drive for reduction from the stepper motor to the capacitor, while the improved version uses a gear-driven reduction unit.

How It Works

The IsoLoop has a wonderfully elegant design. It is a simple tuned LC circuit, with the aluminum band providing the L and the custom designed capacitor providing the C. The connection to the antenna is made through mutually coupled air core inductors. The one-turn electrostatically shielded loop is inductively coupled to the resonating loop. Undoubtedly, many of you have already recognized this as the same design common to antennas used by BCB (BroadCast Band) DX enthusiasts. The difference between this antenna and the IsoLoop is twofold. The IsoLoop is designed for much higher frequencies and so is actually quite efficient in spite of its small size. Its efficiency ranges from about 70% on 20m to as high as about 95% on 10m.

The second principle difference is the capacitor in the IsoLoop. Designed for transmitting, it is capable of about 150W. Its split stator design avoids the moving contacts required by conventional designs. The IsoLoop achieves the ideal of placing the tuner at the antenna. This antenna tuner does what its name says: tunes the antenna! Because the IsoLoop is actually resonant, it easily outperforms practical dipoles mounted at the same height. There is some misunderstanding concerning the ability of a small antenna to perform well in the HF bands. The fact is, what is important is resonance—and this antenna resonates.

Installing the IsoLoop

Unpacking the IsoLoop is easy; it is packed in a box slightly smaller than the IsoLoop's diameter. Two small cardboard boxes contain the LC-2 controller, its power supply, and male-to-male 1/8-inch phone patch cord. The antenna slides from the box with little effort, and its 18-pound weight is not too difficult for one person to handle. Out of the box the antenna is set up for axial mounting, parallel to the earth. In this configuration

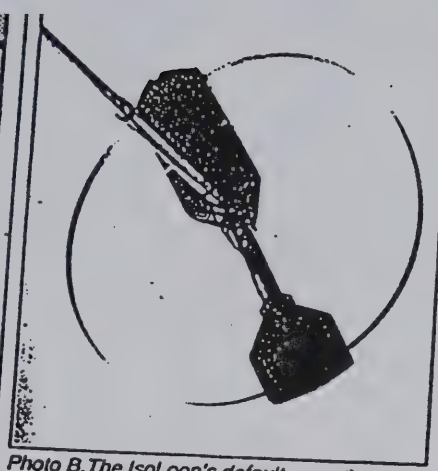


Photo B. The IsoLoop's default mounting position is parallel to the earth and provides an omnidirectional pattern.

the antenna's radiation pattern is omnidirectional. A bidirectional pattern is also possible using the alternate mounting position, which places the antenna perpendicular to the earth. Since the antenna is especially good for restricted space installations—like apartment buildings—using the alternate (radial) mounting position may prove useful for installing the antenna on high-rise balconies and out of windows.

When choosing a mounting location, keep in mind that the IsoLoop will only perform properly when mounted at least four feet from large—especially metallic—objects. This includes four feet from the ground, which, while it sounds like a relatively poor location, is not necessarily that bad. The IsoLoop is a loop antenna and not a dipole. It does not suffer from the problems of a dipole located closer than a half wavelength to the earth. While four feet off the ground is clearly not ideal, the IsoLoop's radiation angle is about 37 degrees, while only a quarter wave from the earth. This low radiation angle insures better DX performance by delivering most of the transmitter's power at an angle that will take advantage of ionospheric propagation. Remember: The angle of incidence equals the angle of reflection.

While the IsoLoop was being tested here, it spent most of its time on a four-foot aluminum stepladder in the middle of the second-floor ham shack. Even in this makeshift installation the antenna performs exceptionally. In any case, while the IsoLoop is more forgiving than other antenna designs, it still works better mounted higher in the air. Its relatively small size allows for mounting with standard TV mast and hardware, and its low profile is unlikely to cause too much consternation among the neighbors.

Once the mounting location is chosen, and the antenna physically mounted, the feedline and control cable must be routed back to the transceiver. Supplied with the antenna is a right-angle adapter for the SO-239 input to the antenna. This allows the coax to be routed at 90 degrees to the antenna which minimizes induced currents in the feedline. A small piece of Coax Seal™ is included to protect the antenna connection. Fifty feet of control cable comes installed on the antenna. If this is not enough, AEA can supply 50-foot extension cables. The 5-pin DIN connector used on the control cable is a common type, and the cable itself is a shielded 5-conductor cable, so building one yourself of arbitrary length should be no problem.

Once the cables are routed back to the shack, the coax is connected to the transceiver and the control cable is connected to the 5-pin DIN connector on the back of the LC-2 control box. The LC-2 will also need its power supply connection. The supplied patch cord is used to connect the rig's speaker output to the input on the back of the unit, and an external speaker is plugged into the adjacent output. These connections are only neces-

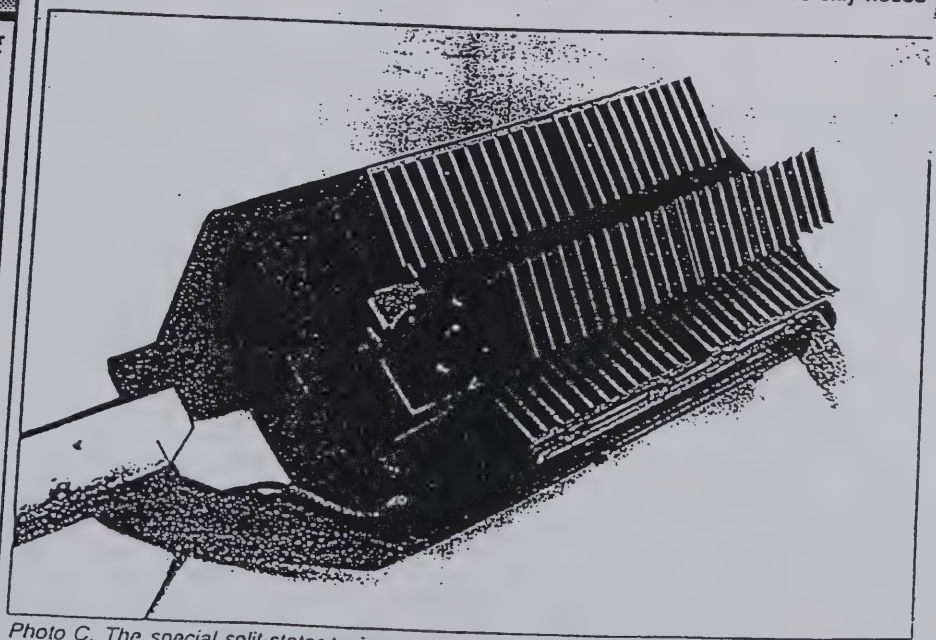


Photo C. The special split-stator tuning capacitor built into the IsoLoop is capable of handling up to 150 watts. The capacitor is remotely tuned via a motorized gear-driven reduction unit.

Advanced Electronic Applications, Inc.

AEA TUNING INDICATOR

OPERATING MANUAL

MODEL TI-1

P.O. Box C2160 • Bldg O & P—2006-196th SW • Lynnwood, Wa. 98036-0918
(206) 775-7373 Telex: 152571 AEA INTL

040-020 July 1984

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AEA TUNING INDICATOR

MODEL TI-1

OVERVIEW

The TI-1 is a spectral display unit for use in tuning RTTY signals. It has three ranges, 170, 425, and 850 Hz and will indicate proper tuning, frequency shift and signal quality. It is connected to the receiver speaker audio and may be used with any terminal unit or interface using the standard North American RTTY tones.

CONNECTIONS

Either of the two 3.5 mm input jacks may be used as the audio input connection. The audio input should connect to your transceiver/receiver external speaker jack. The other jack may be used to connect to your computer interface audio input jack. The two jacks are in parallel.

The TI-1 requires 13.5 VDC and draws approximately 55ma. The center pin of the coaxial power connector must be positive. Polarity reversal will cause an internal fusable link to blow. The link may be repaired with a short section of #30 copper wire.

CONTROLS AND INDICATORS

The power switch is a three position switch that controls both power and the internal monitor speaker. The down position is power and speaker off, the center position is power on-speaker off, and the up position is power and speaker on.

The shift switch selects the frequency range of the Indicator and its use is explained in a later section.

The LED bargraph indicates the frequency of the input signal. You may test the operation of the TI-1 by tuning across a continuous carrier or a CW signal. The display should be dark with no input signal, and lit when the "test tone" is in the proper frequency range. High noise levels will activate the display.

OPERATION

If you know the shift of the signal you are tuning, set the shift selector to the appropriate position; otherwise, start out in the 850 position. The TI-1 display will only light up when a signal tone is within its frequency range.

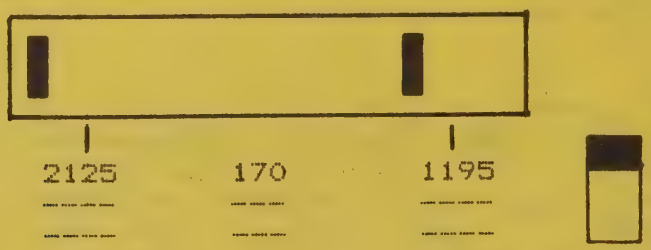
Two intensified zones on the LED bargraph should move across the display as you tune. Zone spacing indicates the amount of shift of the sending station. If you are in the 850 Hz position and the station you are receiving is sending 170 shift, the zones will be very close together. If the station is using 425 Hz shift, the zones will be separated by about one-half the display width. Set the shift switch to the appropriate position and tune the receiver so the intensified zones are above the cursor lines. If the sending station's shift is too wide, the zones will extend beyond the cursors; if too narrow, they should be between the cursors and centered. Weak or noisy signals will have fat intensified zones with several LED bars lit. Strong clear signals will light one or two bars at each end of the display. A signal is tuned in properly when each of the two intensified zones is centered over a cursor marking.

In order to tune Amtor or Sitor stations, the display is designed to blank out when there are no signals within its frequency range. Strong background noise will defeat the blanking features causing the display to light up indiscriminately. Amateur RTTY signals are composed of a mix of mark and space tones with five tone combinations representing one character in the baudot coding system. When a station is in idle (no character being sent) only the mark tone will be present and will be indicated by the TI-1 with one intensified zone. Inverted transmissions are indicated by an intensified zone above the 2125 Hz cursor during the presence of a space tone. Proper phasing is indicated by an intensified zone above the 2125 Hz cursor during the mark tone.

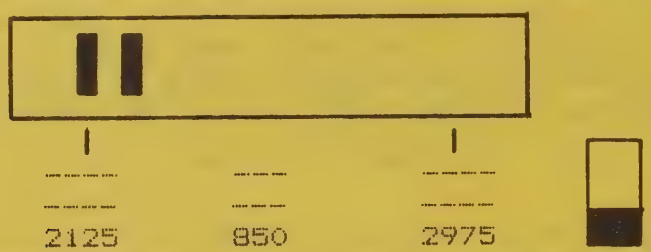
Amateur band TOR stations (Amtor) may not be on exactly the same frequency and the display will show the offset when both stations are heard. The offset is shown by a position shift on the display during the TOR handshake. For ARQ listen, try to average the two stations around the cursors.

TUNING EXAMPLES

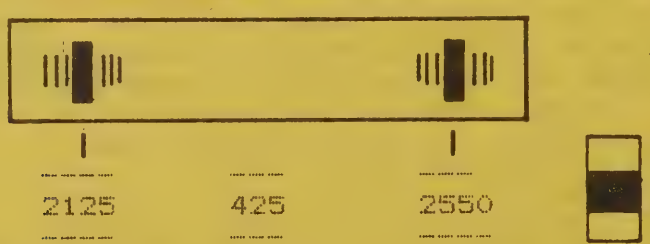
DISPLAY INDICATES 170 Hz SHIFT, RECEIVER FREQUENCY LOW



DISPLAY INDICATES 170 Hz SHIFT, BUT INDICATOR IS IN 850 Hz RANGE

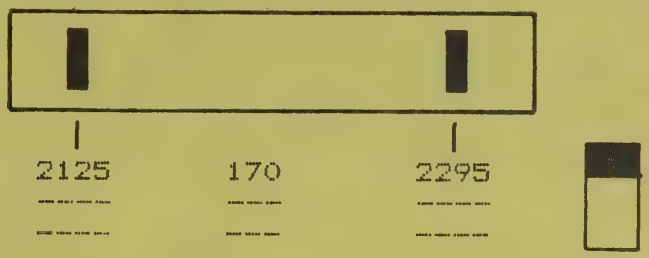


DISPLAY INDICATES 425 Hz SHIFT AND TUNED-IN CORRECTLY,
BUT SIGNAL IS WEAK OR NOISY

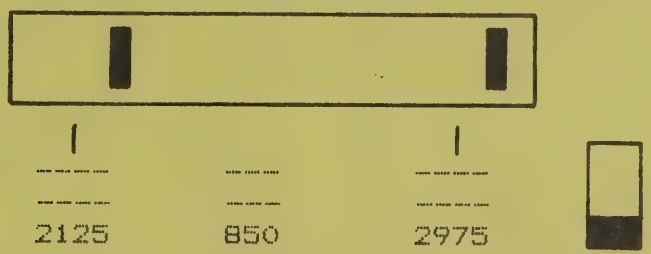


DISPLAY INDICATES PROPERLY TUNED-IN, BUT TRANSMITTING
STATION USING A SHIFT LARGER THAN 170 Hz

DISPLAY SHOWS PROPER TUNING OF 170 Hz SHIFT



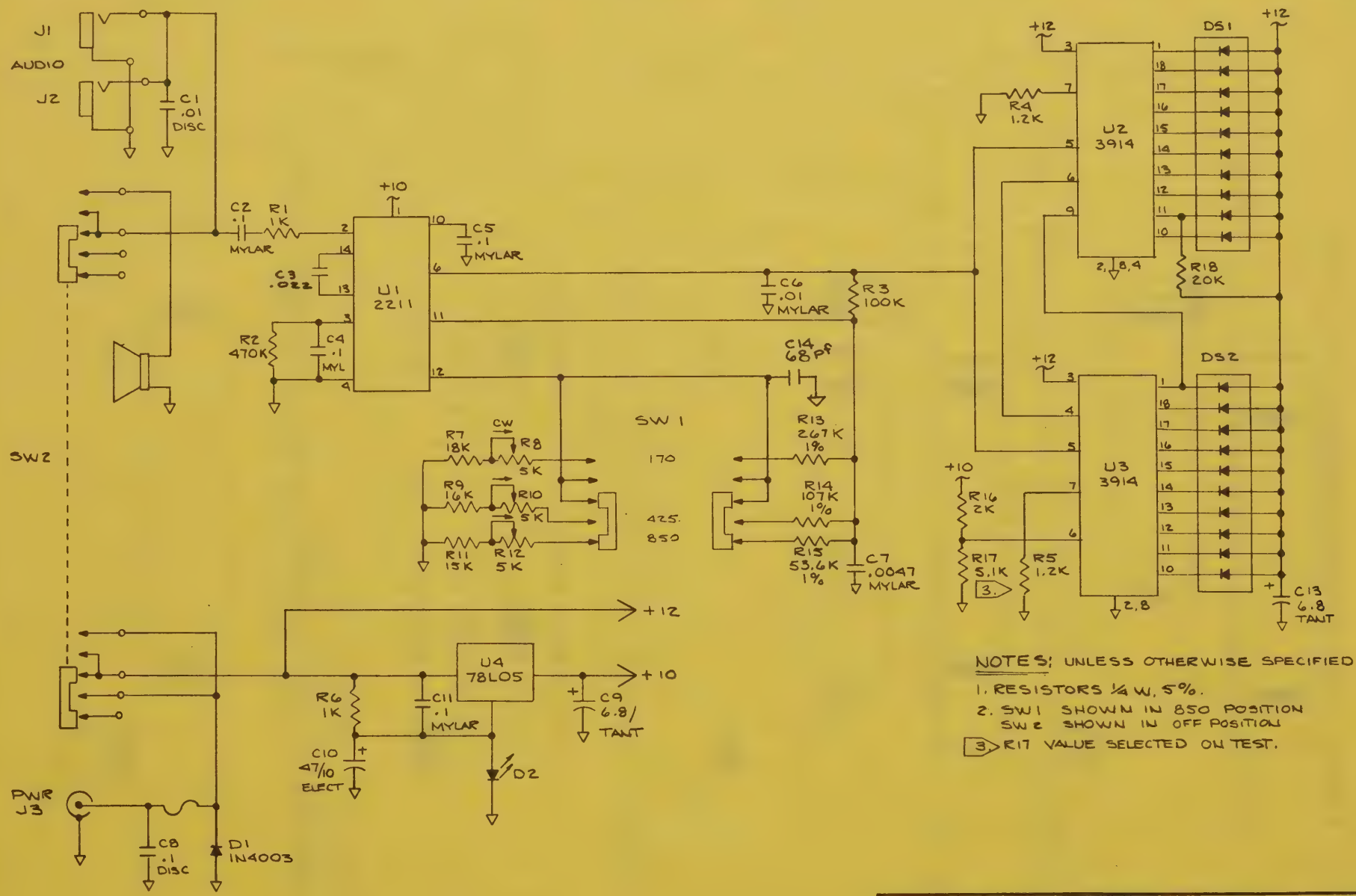
DISPLAY INDICATES 850 Hz SHIFT, RECEIVER FREQUENCY HIGH



TI-1 SPECIFICATIONS

Shift	Frequency Range	Resolution
170 Hz	2095-2325 Hz	12 Hz
425 Hz	2050-2625 Hz	30 Hz
850 Hz	1975-3125 Hz	60 Hz

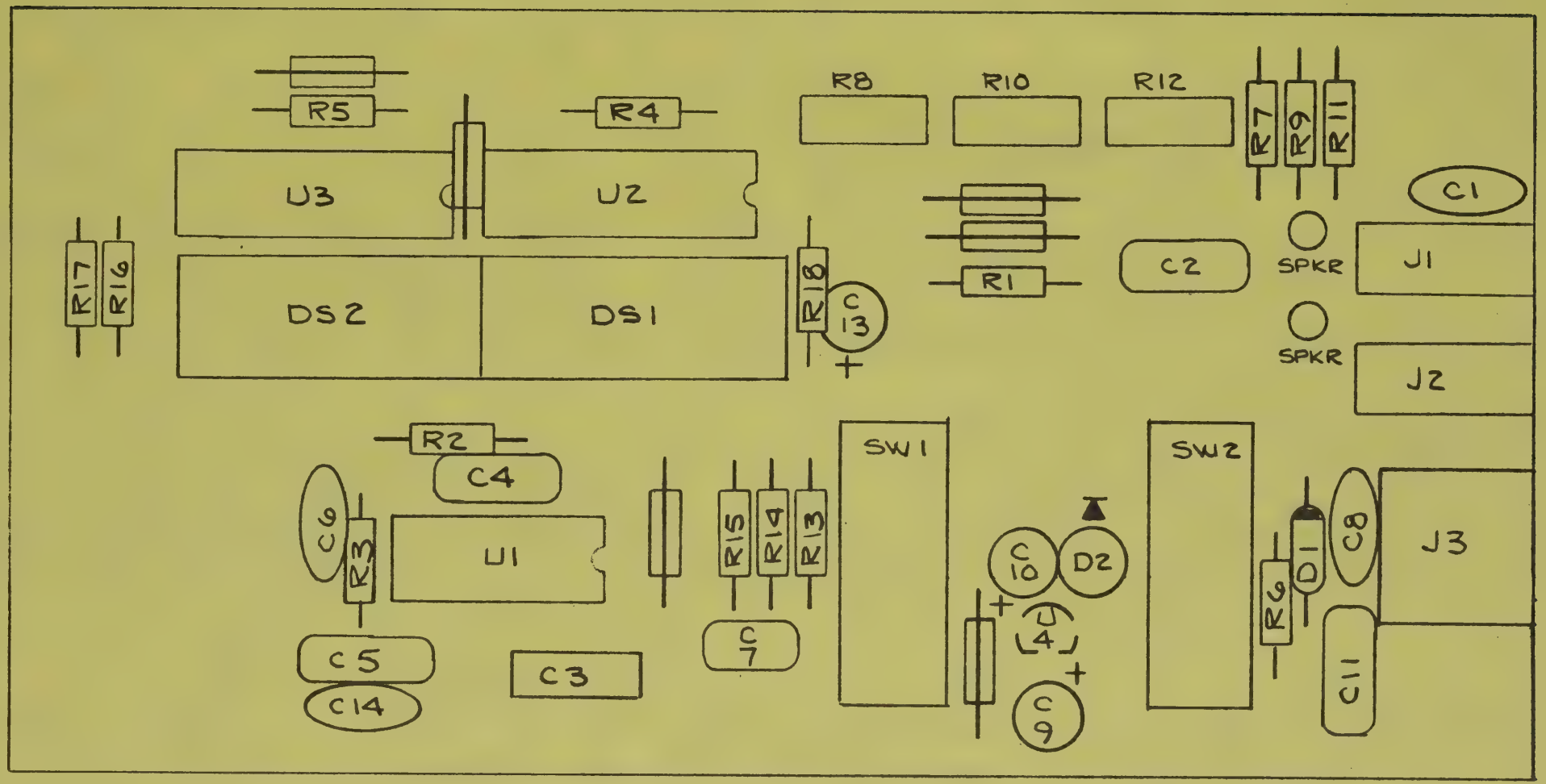
Input level: 50mv-1v RMS
Monitor speaker: 8 ohms, 250 mw
Power required: 13.5VDC, plus or minus 1.5 at 60ma



NOTES; UNLESS OTHERWISE SPECIFIED.

1. RESISTORS ¼ W, 5%.
2. SW1 SHOWN IN 850 POSITION
   SW2 SHOWN IN OFF POSITION
3. R17 VALUE SELECTED ON TEST.

UNLESS OTHERWISE SPECIFIED DIM. AND TOL. ARE IN INCHES AND SHALL BE INTERPRETED PER ANSI (Y 14.5-1986.) TOLERANCES ARE: 1 DEC ±: .1 2 DEC ±: .02 3 DEC ±: .005 4 DEC ±: .0005 ANGLES ±: 0°30' REMOVE BURRS, BRK SHARP EDGES MACH SURFACES 125	ADVANCED ELECTRONIC APPLICATIONS INC.	
	SCHEMATIC DIAGRAM TI-1	
DRAWN HARTLEY 3/1/19 CHECKED / / APP'D / /	SIZE C	DWG. NO. 012-037 REV. B
	SCALE: NONE UNIT WT:	SHEET 1 OF 1



PARTS PICTORIAL
TI-1

PARTS LIST

REFERENCE	AEA PART NO.	DESCRIPTION
	013-041	PCB TI-1
C6	110-103	Capacitor, mylar .01
C2,4,5,11	110-104	Capacitor, mylar .1
C7	110-472	Capacitor, mylar .0047
C1	121-103	Capacitor, ceramic .01
C8	121-104	Capacitor, ceramic .1
C14	123-680	Capacitor, ceramic 68pf
C10	130-476	Capacitor, elect. 47/10
C3	132-223	Capacitor .022
C9,13	140-685	Capacitor, tant 6.8/25
R1,6	210-102	Resistor, 1/4W, 5% 1k
R3	210-104	Resistor, 1/4W, 5% 100k
R4,5	210-122	Resistor, 1/4W, 5% 1.2k
R11	210-153	Resistor, 1/4W, 5% 15k
R9	210-163	Resistor, 1/4W, 5% 16k
R7	210-183	Resistor, 1/4W, 5% 18k
R16	210-202	Resistor, 1/4W, 5% 2k
R18	210-302	Resistor, 1/4W, 5% 20k
R2	210-474	Resistor, 1/4W, 5% 470k
R17		Value set at test
R14	211-107	Resistor, 1/4W, 1% 107k
R13	211-264	Resistor, 1/4W, 1% 267k
R15	211-533	Resistor, 1/4W, 1% 53.6k
R8,10,12	251-502	Trim Pot 5k
D1	311-003	Diode, power 1N4003
D2	314-010	Diode, LED grn TLHG6400
DS1,2	314-010	LED Array 10 Seg Bargraph
U4	330-005	I.C. Volt Reg 78L08
U1	330-046	I.C. 2211
U2,3	330-050	I.C. LM3914
DS1,2	400-020	Socket 20 pin
J3	420-001	Connector, power 2.1mm
J1,2	420-002	Connector, phone 3.5mm
SW1,2	503-003	Switch, slide DP3T
	060-040	Chassis Rear TI-1
	060-041	Chassis Front TI-1
	761-002	Speaker
	420-003	Power Plug 2.1mm
	420-010	Phone Plug 3.5mm
	040-901	Warranty Card
	040-020	Operating Manual TI-1

IN CASE OF DIFFICULTY

If, after re-reading this manual, you are having difficulties, a telephone call to the factory Customer Service Department will likely provide a quick answer to your problems. Before calling the factory, try to have the TI-1 in operation near the telephone so that our technician can talk you through the problems. Our telephone number is (206) 775-7373. Office hours are 0800 to 1630 Pacific Time Zone.

Advanced Electronic Applications, Inc.

AEA TUNING INDICATOR

OPERATING MANUAL

MODEL TI-1

P.O. Box C2160 • Bldg O & P—2006-196th SW • Lynnwood, Wa. 98036-0918
(206) 775-7373 Telex: 152571 AEA INTL

040-020 July 1984

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AEA TUNING INDICATOR

MODEL TI-1

OVERVIEW

The TI-1 is a spectral display unit for use in tuning RTTY signals. It has three ranges, 170, 425, and 850 Hz and will indicate proper tuning, frequency shift and signal quality. It is connected to the receiver speaker audio and may be used with any terminal unit or interface using the standard North American RTTY tones.

CONNECTIONS

Either of the two 3.5 mm input jacks may be used as the audio input connection. The audio input should connect to your transceiver/receiver external speaker jack. The other jack may be used to connect to your computer interface audio input jack. The two jacks are in parallel.

The TI-1 requires 13.5 VDC and draws approximately 55ma. The center pin of the coaxial power connector must be positive. Polarity reversal will cause an internal fusable link to blow. The link may be repaired with a short section of #30 copper wire.

CONTROLS AND INDICATORS

The power switch is a three position switch that controls both power and the internal monitor speaker. The down position is power and speaker off, the center position is power on-speaker off, and the up position is power and speaker on.

The shift switch selects the frequency range of the Indicator and its use is explained in a later section.

The LED bargraph indicates the frequency of the input signal. You may test the operation of the TI-1 by tuning across a continuous carrier or a CW signal. The display should be dark with no input signal, and lit when the "test tone" is in the proper frequency range. High noise levels will activate the display.

OPERATION

If you know the shift of the signal you are tuning, set the shift selector to the appropriate position; otherwise, start out in the 850 position. The TI-1 display will only light up when a signal tone is within its frequency range.

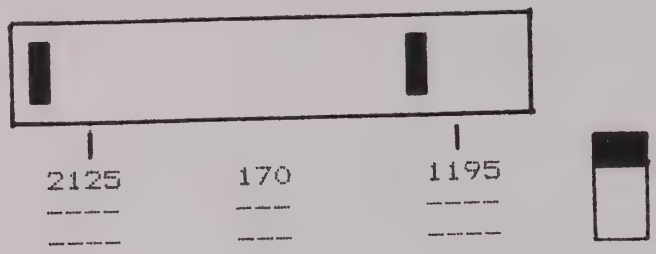
Two intensified zones on the LED bargraph should move across the display as you tune. Zone spacing indicates the amount of shift of the sending station. If you are in the 850 Hz position and the station you are receiving is sending 170 shift, the zones will be very close together. If the station is using 425 Hz shift, the zones will be separated by about one-half the display width. Set the shift switch to the appropriate position and tune the receiver so the intensified zones are above the cursor lines. If the sending station's shift is too wide, the zones will extend beyond the cursors; if too narrow, they should be between the cursors and centered. Weak or noisy signals will have fat intensified zones with several LED bars lit. Strong clear signals will light one or two bars at each end of the display. A signal is tuned in properly when each of the two intensified zones is centered over a cursor marking.

In order to tune Amtor or Sitor stations, the display is designed to blank out when there are no signals within its frequency range. Strong background noise will defeat the blanking features causing the display to light up indiscriminately. Amateur RTTY signals are composed of a mix of mark and space tones with five tone combinations representing one character in the baudot coding system. When a station is in idle (no character being sent) only the mark tone will be present and will be indicated by the TI-1 with one intensified zone. Inverted transmissions are indicated by an intensified zone above the 2125 Hz cursor during the presence of a space tone. Proper phasing is indicated by an intensified zone above the 2125 Hz cursor during the mark tone.

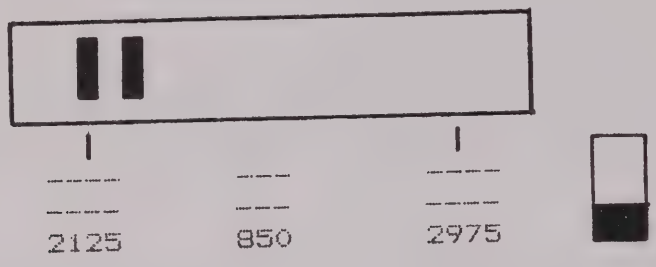
Amateur band TOR stations (Amtor) may not be on exactly the same frequency and the display will show the offset when both stations are heard. The offset is shown by a position shift on the display during the TOR handshake. For ARQ listen, try to average the two stations around the cursors.

TUNING EXAMPLES

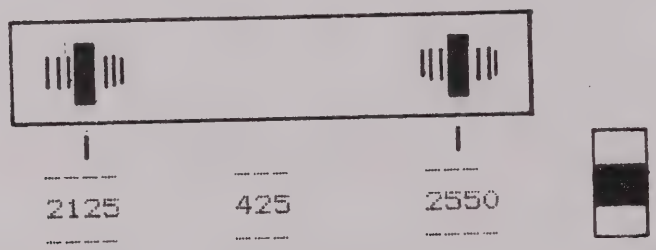
DISPLAY INDICATES 170 Hz SHIFT, RECEIVER FREQUENCY LOW



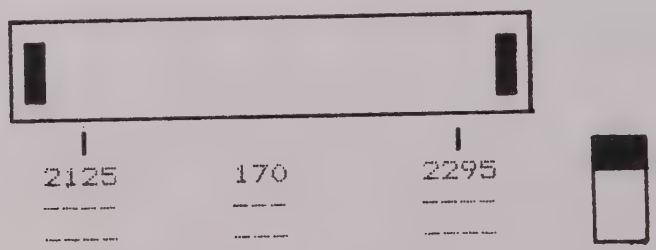
DISPLAY INDICATES 170 Hz SHIFT, BUT INDICATOR IS IN 850 Hz RANGE



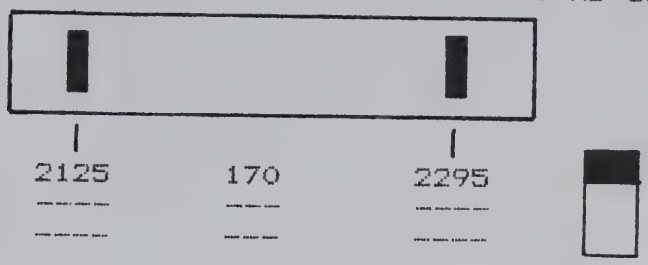
DISPLAY INDICATES 425 Hz SHIFT AND TUNED-IN CORRECTLY, BUT SIGNAL IS WEAK OR NOISY



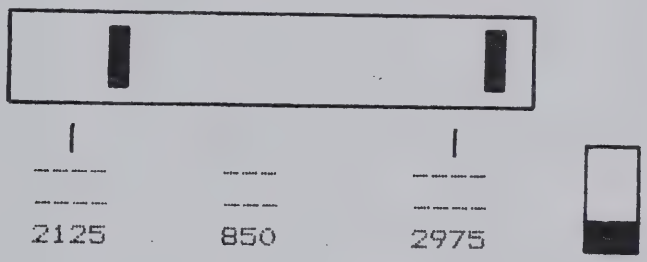
DISPLAY INDICATES PROPERLY TUNED-IN, BUT TRANSMITTING STATION USING A SHIFT LARGER THAN 170 Hz



DISPLAY SHOWS PROPER TUNING OF 170 Hz SHIFT



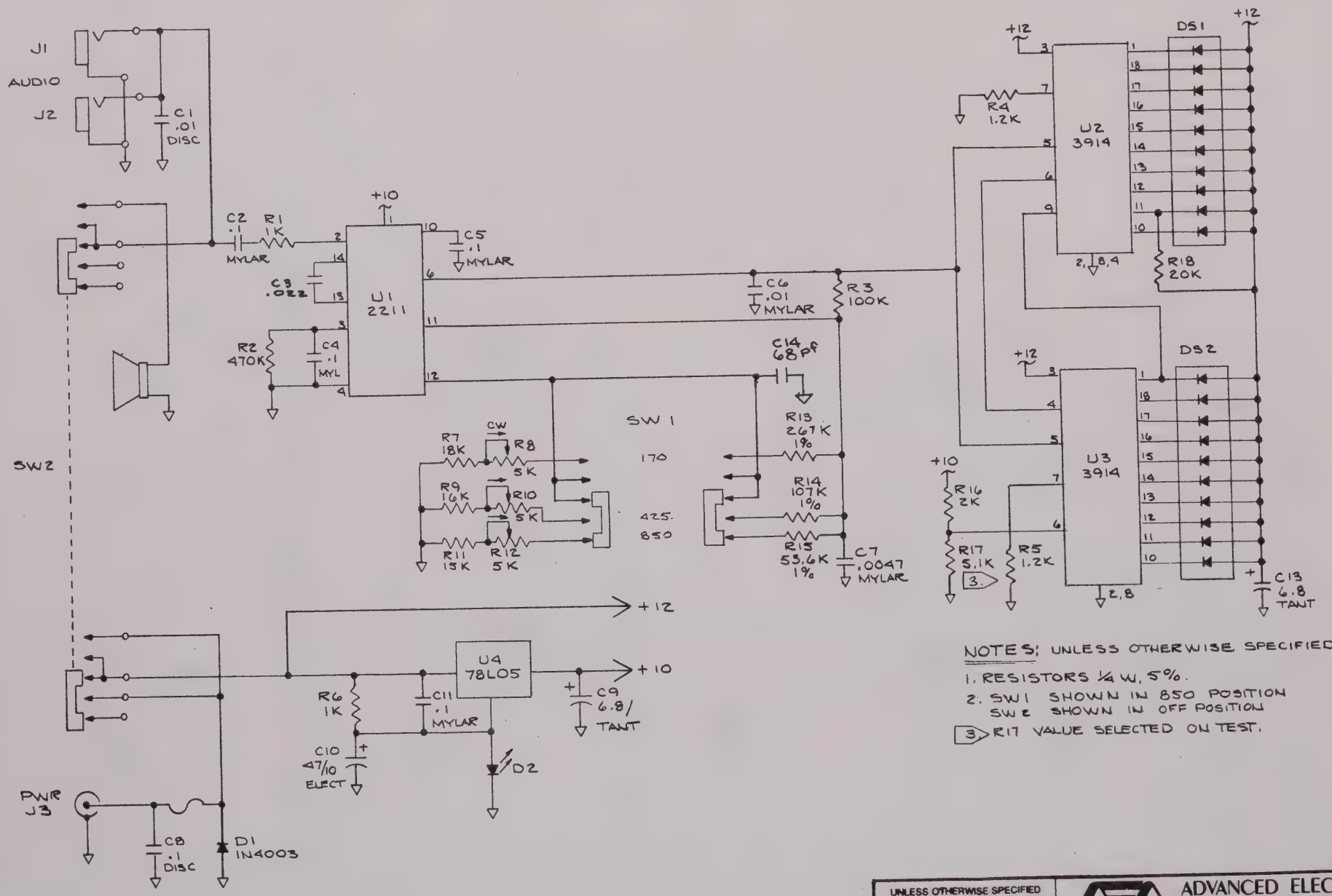
DISPLAY INDICATES 850 Hz SHIFT, RECEIVER FREQUENCY HIGH



TI-1 SPECIFICATIONS

Shift	Frequency Range	Resolution
170 Hz	2095-2325 Hz	12 Hz
425 Hz	2050-2625 Hz	30 Hz
850 Hz	1975-3125 Hz	60 Hz

Input level: 50mv-1v RMS
Monitor speaker: 8 ohms, 250 mw
Power required: 13.5VDC, plus or minus 1.5 at 60ma



NOTES: UNLESS OTHERWISE SPECIFIED.

1. RESISTORS ¼ W, 5%.
2. SW1 SHOWN IN 850 POSITION
   SW2 SHOWN IN OFF POSITION
3. R17 VALUE SELECTED ON TEST.

UNLESS OTHERWISE SPECIFIED DIM. AND TOL. ARE IN INCHES AND SHALL BE INTERPRETED PER ANSI (Y 14.5-1986.)
TOLERANCES ARE:
1 DEC ±: .1 3 DEC ±: .005
2 DEC ±: .02 4 DEC ±: .0005
ANGLES ±: 0°30'
REMOVE BURRS, BRK SHARP EDGES MACH SURFACES "√"

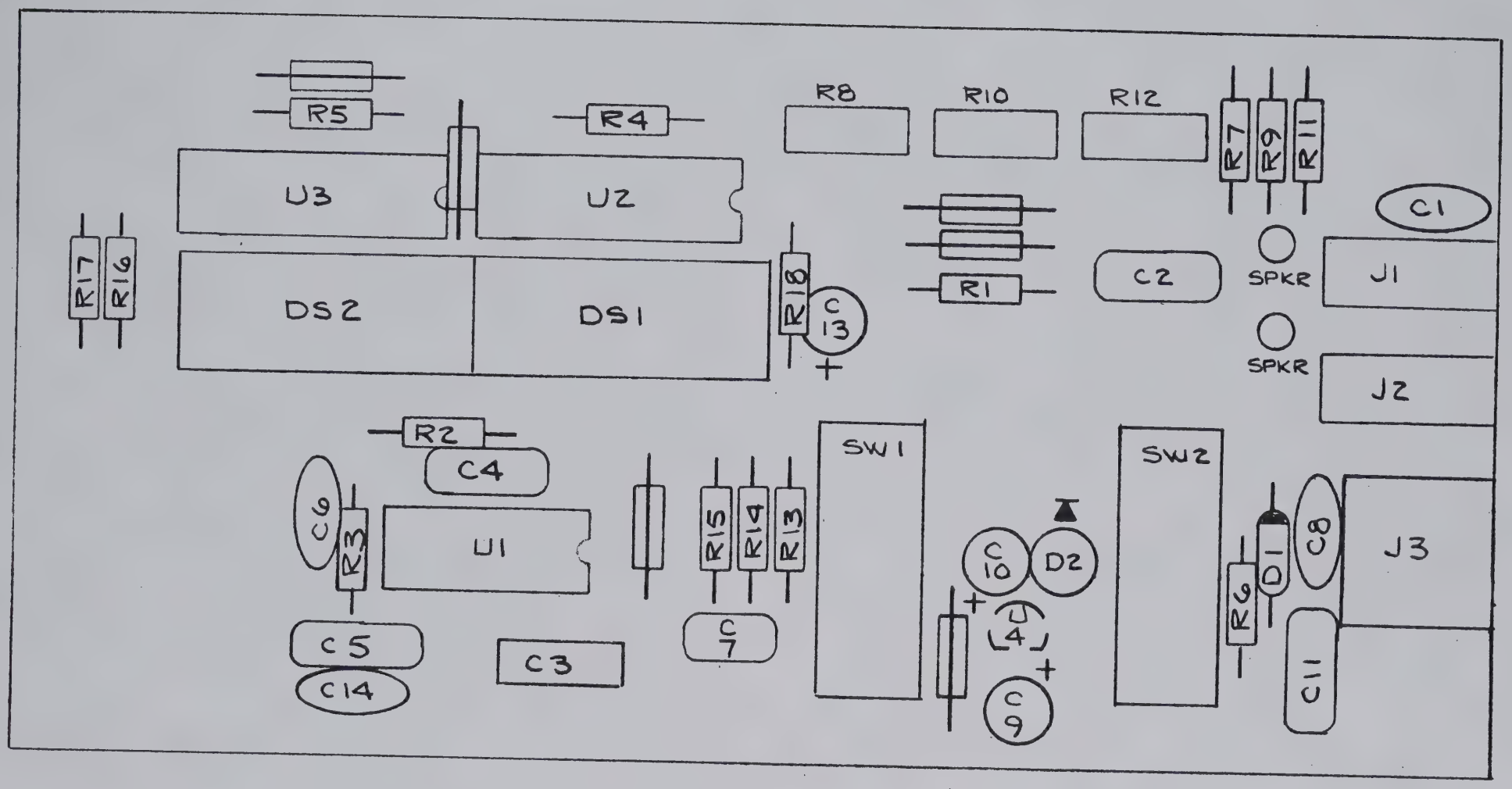
DRAWN	HARTLEY	3/1/19
CHECKED		/ /
APP'D		/ /

ADVANCED ELECTRONIC APPLICATIONS INC.

SCHEMATIC DIAGRAM
TI-1

SIZE C | DWG. NO. 012-037 | REV. B

SCALE: NONE | UNIT WT: | SHEET 1 OF 1



PARTS PICTORIAL
TI-1

PARTS LIST

REFERENCE	AEA PART NO.	DESCRIPTION
	013-041	PCB TI-1
C6	110-103	Capacitor, mylar .01
C2,4,5,11	110-104	Capacitor, mylar .1
C7	110-472	Capacitor, mylar .0047
C1	121-103	Capacitor, ceramic .01
C8	121-104	Capacitor, ceramic .1
C14	123-680	Capacitor, ceramic 68pf
C10	130-476	Capacitor, elect. 47/10
C3	132-223	Capacitor .022
C9,13	140-685	Capacitor, tant 6.8/25
R1,6	210-102	Resistor, 1/4W, 5% 1k
R3	210-104	Resistor, 1/4W, 5% 100k
R4,5	210-122	Resistor, 1/4W, 5% 1.2k
R11	210-153	Resistor, 1/4W, 5% 15k
R9	210-163	Resistor, 1/4W, 5% 16k
R7	210-183	Resistor, 1/4W, 5% 18k
R16	210-202	Resistor, 1/4W, 5% 2k
R18	210-302	Resistor, 1/4W, 5% 20k
R2	210-474	Resistor, 1/4W, 5% 470k
R17		Value set at test
R14	211-107	Resistor, 1/4W, 1% 107k
R13	211-264	Resistor, 1/4W, 1% 267k
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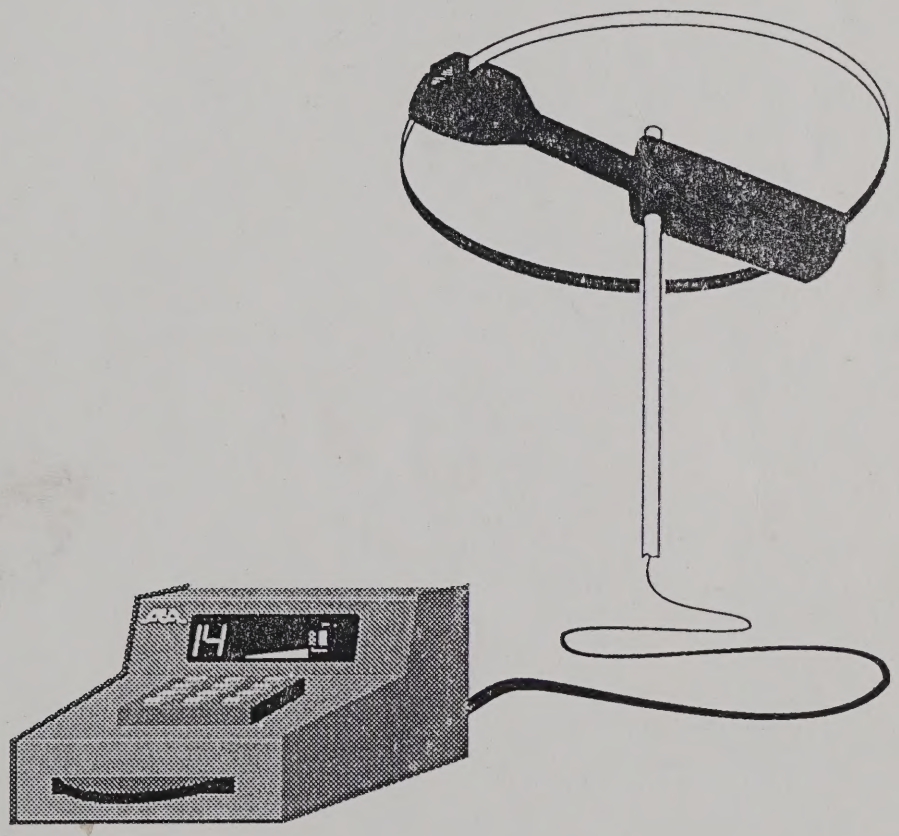
IT-1 IsoTuner

automatic tuner for the IsoLoop 10-30



Operating Manual

AEA Part Number 040-069

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